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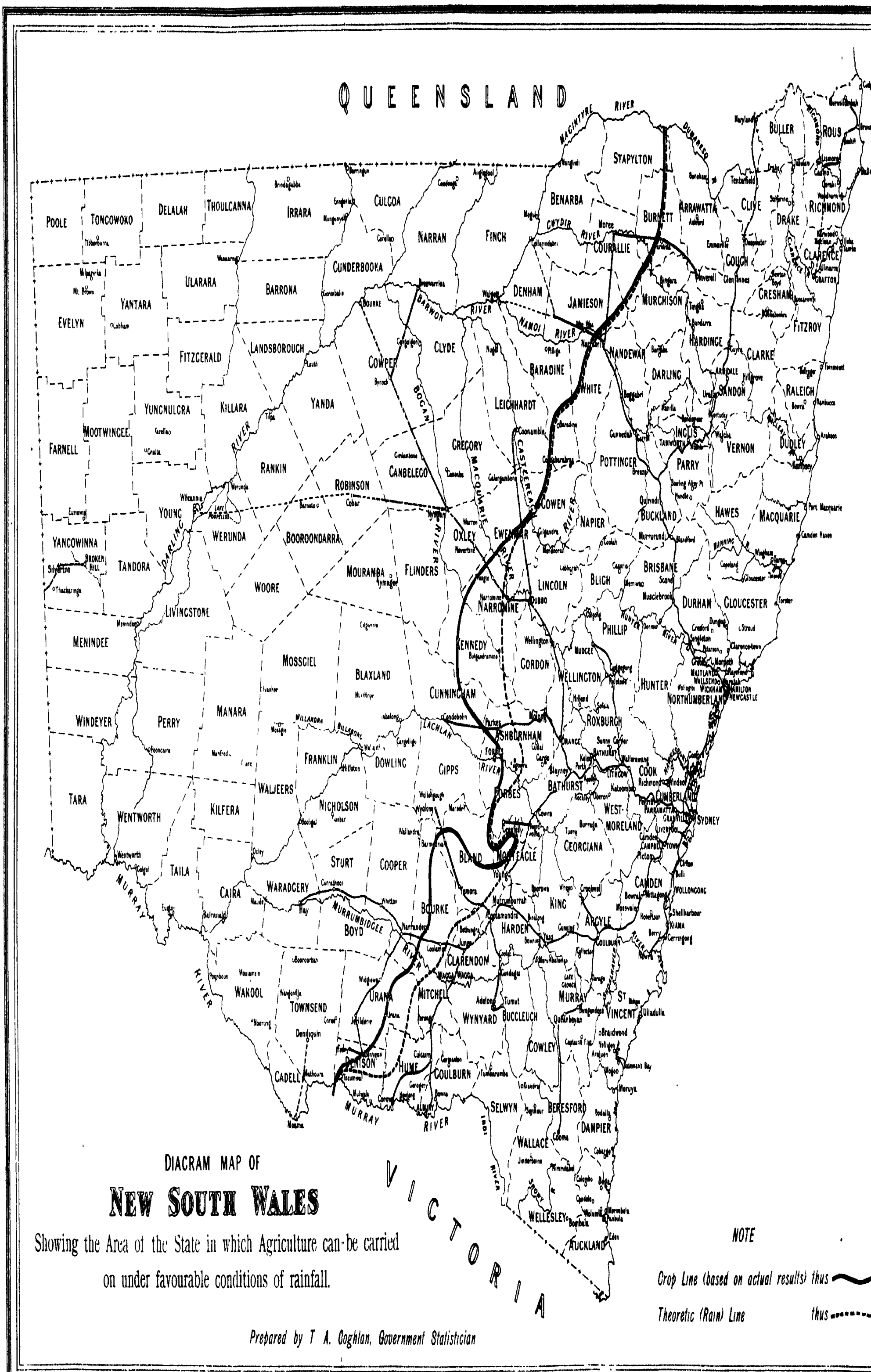


DIAGRAM MAP OF

NEW SOUTH WALES

Showing the Area of the State in which Agriculture can be carried on under favourable conditions of rainfall.

Prepared by T. A. Coghlan, Government Statistician

VOL. XVI. PART 1. JANUARY 3, 1905.

Agricultural Gazette of New South Wales.

Memorandum Regarding Area of New South Wales Suitable for Wheat Growing.

T. A. COGHLAN.

THE accompanying map has two lines drawn across its face. Of these the solid line denotes the part of the State which has theoretically

(*a*) sufficient rainfall to admit of ploughing operations being carried out at the right time;

(*b*) sufficient also to cover the growing period of the wheat plant, and

(*c*) sufficient rainfall during the months of September and October to fill the grain, or, in the case of districts where, notwithstanding the rains in these months are light, the deficiency is made up by the increased falls in the earlier or later months.

The dotted line represents the westward limit of profitable wheat-growing based upon actual results. During the last eleven years careful records have been kept of the results of the harvest of every district of the State, and from these records of actual experience, it has been possible to establish the line thus laid down.

It is to be remembered in discussing the "crop" line that the average crops recorded over the greater part of Riverina are below what might be obtained, as it is unfortunately true that the majority of the farmers do not get anything like the results from their land that are possible under good treatment. In many instances the land is badly prepared, the grain sown too late, the methods of harvesting wasteful (much of the grain being lost), and the use of fertilisers is not by any means general. Experts place the loss as high as two bushels per acre, and rarely less than one bushel; and it is certain that the average yields would be considerably increased with better farming conditions. In determining the "crop" line, therefore, consideration was given to the poor results attributable to bad farming, as well as to losses by other preventible causes, such as by rabbits, bush fires, &c.

It will be seen that the "crop" line extends westward of the theoretic (rain) line in certain places; but speaking generally, it may be affirmed that the test of experience confirms the correctness of the rainfall line as the limit of successful wheat-growing, for whereas east of that line the harvest results are practically certain, to the westward there are few places where the farmers can count on more than seven crops out of ten.

With present evidence then, the solid line seems to mark the western limit of wheat cultivation, and a more rigid definition of successful farming might even exclude districts now placed within the wheat area.

For example, the Mulwala district in County Denison shows two failures in ten years; Tocumwal, in part of which good crops are gathered, shows, for ten years, the following averages:—11·4, 11·4, 12·8, 12·0, 2·9, 5·1, 14·0, 7·4, 1·7, and 18·0 bushels per acre.

Berrigan, which is outside the "rain" line and partly within the "crop" line, gave the following results during the last ten years:—12·6, 13·6, 11·7, 6·5, 0·1, 3·2, 12·2, 6·9, 0·7, and 21·5 bushels, or three failures in ten years.

The Daysdale district, which is outside the "rain" line but within the "crop" line, shows one failure, and less than one and a half bags during other two years of the last decade. Lockhart, which is on the limit of the "rain" line, shows three failures in ten years.

Urana shows three and probably four failures in ten years, and Finley, which during the last seven years gave the following results:— 6·4, 1·5, 2·1, 11·7, 4·8, 0·2, and 17·9 bushels per acre, are both outside the crop line.

Going north, it will be seen that Wagga is just inside the rainfall line. Here September and October rains are rather short, but winter and August rains are fairly heavy, and in the light soils results are fair. Still, the part of the Wagga district within the County of Clarendon shows two failures in ten years, and the part in the County of Mitchell gives the following yields:—6·2, 5·3, 7·3, 1·0, for four years in ten.

Within the "crop" line, Ganmain and Coolamon are included, though they are doubtful; during the last ten years there were two absolute failures, and some other years show low yields. Narrandera shows three failures in ten years, and is therefore doubtful, while Grong Grong must be left out, as there were not only three failures in ten years, but in other years poor yields were the rule. Even so far east as Cootamundra, under present conditions, the average is under eight bushels for five years out of ten, though only one absolute failure is recorded.

Further north, it will be seen that the rainfall line runs east of Temora. In this district the spring rains are light, but as much of the country, owing to its elevation of over 1,000 feet above the sea, suffers little from evaporation, and as the soil is light in texture and very receptive of moisture, the full spring rains elsewhere required are not absolutely necessary. Still, in the Temora district, averages of 6·3, 5·8, 3·5, 6·4, 1·2 bushels for five years out of ten, show lack of rain, and some change is necessary in the farming conditions if wheat-growing is to be a success.

It will be seen that the "crop" line runs as far west as the town of Barmedman, as present evidence does not show that this district could not grow fair crops of wheat. Last year, in the Barmedman district, 4,700 acres were under wheat, the average area for ten years being about 2,500 acres. The yields are low, but only one absolute

failure (1·2) was recorded, other yields averaging 6·3, 4·3, 6·9, 12·3, 8·3, 5·3, 5·8, 6·1, and 18·5 bushels. This poor show may be due to bad farming, and the available evidence is hardly sufficient to throw this district outside the "crop" line.

Returning east, the rainfall line runs just west of the towns of Young and Grenfell, and near Young the "crop" line meets the "rain" line, both of which just keep to the west of the Crowther, Broula, and Weddin Ranges. This district, especially west and south-west of the line, does not show results encouraging to wheat-growers. In the County of Monteagle, the Young district shows one complete failure, and a harvest of less than one and a half bags per acre for two years in ten. Morangorell, Bimbi, and Grenfell show three failures in ten. In the County of Forbes, Cowra had one failure and two poor yields, and the country in the immediate vicinity of the town of Forbes had one failure and three poor yields in ten years. Further north, the "rain" line runs east of Parkes and just embraces Narromine, where the soil gives good results with moderate rainfall; it then runs north till it joins the "crop" line just west of Gilgandra.

The "crop" line runs west of Parkes, through Fifield and Dandaloo. East of the "rain" line the yields are good, but approaching Eugowra and Parkes low yields are often met with, and further west the returns are lower still. Around Peak Hill yields are irregular, but further north-west, where very small areas are cultivated, yields are better, though in Dandaloo only 2,400 acres are under wheat; Trangie, 6,700; Collie (Dubbo). 1,500; Gowen (Gilgandra), 1,500; and Mendooran, 1,300. These districts have not been sufficiently tested for wheat; the rainfall seems deficient, but on the small areas where wheat is grown results are, as a rule, fair, though both at Dandaloo and Fifield failures were experienced two years in ten. Though this area has been included within the wheat line, according to present experience the propriety of its inclusion is somewhat doubtful.

The line then turns slightly to the north-east, and runs through Narrabri and Warialda to the Queensland border. In some of the northern districts within the "rain" line, much of the land is considered unsuitable for wheat-growing, consisting as it does of stony, hilly country, too rough for cultivation, and of black-soil plains, which bake and crack and present mechanical difficulties in tillage. The rich soils of river flats must also be omitted from good wheat-growing lands, as such land has a tendency to produce excessive straw growth, though heavy crops of hay can, of course, be grown.

The "crop" line, as already mentioned, is based on the experience of wheat cultivation during the last ten years. Prior to 1893 a limited area only was under crop in the country immediately adjacent to the "rain" and "crop" lines, and the averages derived from such areas for the earlier years would not be applicable to the larger areas now under cultivation. It is true that the period that has elapsed since 1893 embraces several dry years, and it may be hoped that the next decade will show better results, in which case it may be possible to extend the "crop" line still further west, but it would be unsafe to do so until the test of actual experience warrants the change.

As regards the "rain" line, however, the experience for most districts of the State extends over a much greater period than ten years, and it is confidently believed that the line as laid down truly represents the rain conditions of the State.

September and October are generally looked upon as the most critical months as regards rainfall—this being the time for the filling of the grain. Heavy soils require more rain than light soils, especially if the latter possess retentive sub-soils. The nature of the soil, then, as well as questions of elevation, temperature, evaporation, &c., have an important bearing on the rainfall needed for wheat and general culture, and there are few matters of more importance in regard to settling people on the land under payable conditions than the question of soil characteristics. A soil map of the State is urgently required, and special attention should be given to the districts within this wheat line. This is, however, a matter not for the Statistician but for the agricultural experts, to whose attention it is strongly recommended.

[The soil map, as recommended by Mr. Coghlan, is now being prepared by the chemist to the Department of Agriculture.]

Estimated Wheat Yield, Season 1904–5.

Districts	Grain.			Hay.		
	Area.	Yield	Average per acre	Area.	Yield.	Average per acre.
	acres.	bushels.	bushels	acres.	tons.	tons.
Coastal Districts . ..	4,188	58,707	14·0	2,871	2,037	0·7
Northern Table-land ...	150,269	2,457.774	16·4	21,084	29,176	1·4
Central Table-land . ..	81,487	763,539	9·4	65,890	38,035	0·6
Southern Table-land	87,334	744,254	8·5	29,431	21,679	0·7
Total Table-land ...	319,090	3,965,567	12·4	116,405	88,890	0·8
North-western Slope ...	61,384	886,252	14·4	16,024	14,752	0·9
Central-western Slope .	377,035	3,036,456	8·1	71,032	49,685	0·7
South-western Slope ...	516,650	5,173,626	10·0	88,919	83,883	0·9
Total Western Slopes..	955,069	9,096,334	9·5	175,975	148,320	0·8
Riverina	296,243	2,945,250	9·9	44,463	42,334	1·0
Western Plains	10,385	55,632	5·4	12,858	7,569	0·6
Total, New South Wales ..	1,584,975	16,121,490	10·2	352,572	289,150	0·8

Government Statistician's Office,
Sydney, 21st December, 1904.

Green Manuring for the Orchard.

W. J. ALLEN.

THE question of green manuring is one which for a long time past has claimed the attention of many of our farmers and fruitgrowers. It is a recognised fact that the soil cannot go on producing year in and year out without the loss of a great amount of the plant-food which nature provides for the sustenance of the tree or crop, and hence it becomes necessary for the grower to assist in replacing as largely as possible the constituents so removed from the soil. One of the best and cheapest methods of doing this is the growing and ploughing under of green crops such as clovers, vetches, peas, cow-peas, lupins, tares, &c., which not only helps to build up the worn-out soil but also assists in keeping the soil in condition when once it has been put into a suitable state of fertility for raising profitable crops.

Green Manure Crop of Tares in Hawkesbury Agricultural College Orchard, 1904.

Many endeavour to keep up the condition of their soil by using bush scrapings, soil and farmyard manure, but as the supply in many cases does not by any means equal the demand, other means of replacing the necessary supply of organic matter, nitrogen, &c., have to be availed of and growing leguminous crops for the purpose of ploughing in has been found one of the best of these.

Speaking more especially of the green manuring of orchards I might say that for the last three years we have sown among the trees

Green Manure Crop of Tares in Hawkesbury Agricultural College Orchard, 1904.

in our Government orchards in the early autumn crops of tares and peas, which later on were ploughed in—that is, before the dry weather had set in. In growing green crops among fruit trees it is necessary

Green Manure Crop of Tares in Hawkesbury Agricultural College Orchard, 1904.

to sow such as will make the best growth in the winter months, as there are few fruit-growing districts in Australia where, in the summer time,

there is sufficient moisture to supply the tree and fruit as well as a crop of cow-peas, &c., among the trees, without injury to the crop or trees, as the green crop would be robbing the trees of the moisture so much required by them to mature their crops of fruit and at the same time develop fruit-bearing wood for the next year's crop. Indeed, in many districts, if such crops were allowed to grow during the summer it would not be long before both trees and crops would be found withered and dying for lack of sufficient moisture.

When orchards are kept continually worked, and even in winter the weeds are not allowed to grow and be turned under, the soil becomes exhausted sooner or later and in consequence becomes unproductive. I am sure that many an orchard throughout our State has become unproductive from a lack of sufficient plant-food to keep the trees in healthy condition; this condition of affairs being evidenced by the

Showing how the growth of a green manure crop is influenced by the application of small quantities of stable manure and decayed vegetable matter spread immediately around the trees in a soil composed of almost pure sand.

appearance of perhaps a few or perhaps many trees which present a yellowish stunted appearance, make but little growth, and show indications of a slow process of starving to death. The leguminous crops such as black tares and peas, which we are using, supply not only humus but nitrogen in considerable quantities from the air through the medium of nodules found on the roots of the plants.

We have found that given a sufficient supply of moisture, black tares and peas will grow well on almost any of our soils, but in old, worn-out soils it is very difficult to grow even a fair crop without the use of manures, and in almost every case we find it an advantage to sow a little blood and bone, superphosphates, or some other manure along with the seed just to give it a fair start. On the poorer soils in our Hawkesbury Agricultural College orchard we have found that even this did not help them sufficiently, but that wherever any stable

manure was used the tares or peas grew well, but where chemical manures only were used on these poor soils the crops made very little growth and were not a success. In poor or worn out orchard soil it would be best where it is possible to give a good dressing of either horse, cow, or sheep manure before sowing, but in the event of none of these being procurable at a reasonable cost, a manuring with blood and bone at time of sowing would be about the next best thing to help the soil and crop.

During the past season in our Wagga, Richmond, Bathurst, and Moree orchards we had in all 90 acres sown to black tares, and for the last three years we have grown these crops in the above-mentioned and the Wollongbar orchards for the purpose of keeping the soil in such condition as to enable the trees to produce profitable crops of fruit without exhausting them, as it must not be forgotten that a tree out of condition may set fruit but yet not have sufficient strength to carry it to maturity, and therefore it drops off very shortly after setting.

I have no hesitation in saying that the results so far obtained from such manuring have been very satisfactory. At Bathurst we ploughed the ground prior to sowing the tares, but at the other orchards the tares were sown immediately after cultivation.

The following is the cost of seed, the manure used for sowing with the seed, and the cost of sowing and scarifying same. At Richmond (H. A. College) orchard 45 lb. of seed was used to the acre, the seed costing 8s. 6d. per bushel, or say 6s. 4d. per acre for seed. Cost of

Preparing the green manure crop for ploughing under, Hawkesbury Agricultural College Orchard.

harrowing twice after sowing and scarifying once before sowing the seed, 2s. 6d. per acre; and 2 cwt. of manure—blood and bone, bonedust, and superphosphates—were used to the acre on the different sections,

costing respectively 11s., 11s. 6d., and 15s.; and the cost of hand-sowing the seed and manure was about 1s. per acre.

It was very difficult to detect any difference in the growth of the

Ploughing under green manure crop of tares, Hawkesbury Agricultural College Orchard.

tares where the different manures were sown, but if there was any difference it was in favour of the blood and bone. Cost per acre, 21s. 4d., except where the superphosphates were sown, in which case the cost, owing to the higher price of the manure, would be increased by 3s. 6d. per acre.

It may be explained that this was the only orchard where it was deemed necessary to use 2 cwt. of manure to the acre, as most of the soil is of a hungry sandy nature.

The drain pipes on portion of the orchard were not working well, and as this was the poorest soil in the orchard, the crop was very light. On the better drained sandy soil the crop was good, and on the sandy loam and chocolate it was very heavy. The seed was sown on the 22nd March, and turned under the first week in September. The disc was run over first, and then the single-furrow plough was used for turning it under. The length of growth was from 18 inches to 2 feet in the light and red sandy loam.

At Wagga the cost of sowing and cultivating at seeding time was only 2s. 6d. per acre, and only about 60lb. of superphosphates was used per acre; but the black tares cost 12s. per bushel, and in this warmer district it is found best to sow the greater quantity.

At Bathurst, 45 lb. of black tares, costing 8s. 3d. per bushel, were sown to the acre. With this was used 90 lb. of Shirley's No. 3 mixture per acre, costing about 3s. 4d. In every case the manure was applied at the time of planting the tares.

At Moree both thin and thick sowing were tried, and the latter did very much better than the former, covering the ground quickly, while

Showing the root-system of tares and peas grown at Hawkesbury Agricultural College.

the former never covered the ground, and stopped growing long before the thickly sown.

Mr. H. W. Potts, Principal of the Hawkesbury Agricultural College, who has made a special study of the bacterial aspect of green manuring, reports :—

"Not the least interesting features in the important green manuring experiments conducted in the College orchard, were the observations taken at regular periods to note the fixation of free atmospheric nitrogen by the bacteria located in the nodules of the plant rootlets.

"This inexpensive process of accumulating and assimilating the most serviceable of all plant-foods has a peculiar attraction for everyone engaged in orchard work and farming.

"The air we breathe contains about four-fifths nitrogen and one-fifth oxygen. It is thoroughly well ascertained that this illimitable store of plant-food, through the agency of bacteria, can be rendered constantly available to replace or supplement the existing supplies of nitrogenous manures under the most economical conditions. It can be clearly illustrated that these micro-organisms live in the soil and enter the tissue of the rootlets of leguminous plants, forming thereon lumps, knobs, nodules, tubercles, warts or warty excrescences, which at one time were looked on as evidences of disease. Fortunately now we are enabled to recognise their beneficent functions and welcome their appearance.

"Their propagation and development are fostered to our advantage. Such depends on the character of the soil, temperature, moisture, the chemical bases available and the variety of soil bacteria. It is not yet ascertained, nor can it be definitely stated, how the legume and micro-organism combine to free nitrogen; most authorities agree that it

Showing the manner in which green crops will deepen a soil.

An average plant from a crop of tares grown for green manure in Wagga Experimental Orchard.

is through the roots and the nodules and the air contained in the interstices of the soil, but the fact is none the less apparent that this essential plant-food is made soluble and available, and is followed by undeniable proofs of increased fertility.

"A well ærated soil is a cogent factor to the vigour and activity of soil-bacteria. This is obtained by cultivation, ploughing, the action of earthworms, decaying rootlets, and other forms of soil movements.

Light, sandy soils are invariably more suitable for this class of fertilising agency.

"It may be found necessary to utilise light dressings of soils taken from lands where legumes have been successfully grown upon soils that are lacking in suitable bacteria or are practically sterile. This form of inoculating soils is now becoming popular and profitable.

"It has been known for centuries that leguminous plants possessed a remarkable power of renovating soils. It is only during the past fifteen years bacteria were recognised as the fertilising agents. Such restorative power is now known to be vital during the life of the plant. In addition, however, it possesses the advantage when ploughed in green of providing humus, for such it may be considered the most important of all factors in light dry soils for increasing their water-holding capacity. No one can gainsay the value of such an important characteristic in our exhausting climate as that of moisture retention.

"The activity of the bacteria and their functions, or in other words the process of nitrification, is largely controlled by the nature of the soil. In light, well ærated soils, nitrification possesses all the stimulating influences essential to its vigour; and the green plants can be turned in with the prospect of a good return; but in heavier soils, owing to the presence of large quantities of decayed vegetable matter and the absence of air, the opposite effect is encouraged and denitrification takes its place, by which plant-food is rendered unavailable.

"In the latter instance practice has to be shaped to meet these altered conditions. It is then best to partially feed off the dense green foliage with sheep. They contribute a quantity of manure, but what is of greater moment they bruise and break up the remainder of the crop so that it becomes partially decomposed or rotten before being turned in.

"Clover, trefoil, lupins, and vetches are noted for growing well on light soils, in fact on land so sandy as to be found almost sterile.

"But the question of a proper legume from which to acquire the best results can only be determined by actual experiment. The legume that grows most luxuriantly upon soils not well fertilised, at the same time producing the most abundant crops of nodules on the rootlets should be selected.

"The character of these growths cannot be estimated as a result of one year's growth.

"The soils in the College orchard are of such varied classes that it would be a huge task to accurately arrive at the amount of nitrogen accumulated during the past five years.

"It may be approximately estimated at from 50 to 100 lb. per acre. On the basis laid down by Mr. Guthrie of ammonium salts and nitrates valuation, the value of nitrogen would be 6·7d per lb., or a cash estimate per acre ranging from £1 7s. 11d. to £2 15s. 10d.

"The first crop of vetches examined during the winter of 1902 on the sandiest portion of the orchard pointed to exceedingly light nitrification. The nodules were very few and were clustered around the base of the rootlets within an inch of the soil surface. The long fine rootlets were delicate and clean, with a general failure of vigour in growth.

"The following winter a distinct improvement was observed; the nodules were more numerous and extended downwards some four or five inches into the soil. This winter a prolific growth of nodules were present along the line of all the sturdy rootlets, some descending to a depth of 11, 12, and 13 inches, and nitrification proceeding with full power and accumulating vigour."

Bacterial Nodules (natural size) on roots of tares at Hawkesbury Agricultural College Orchard.

Tares taken from a square yard from the Bathurst and Richmond orchards were forwarded to the Departmental Chemist, Mr. F. B. Guthrie, for analysis. Mr. Guthrie has made an estimate of the approximate value per acre. Samples of soil were taken from ground on which tares were grown, as also similar soil where they had not been grown. Mr. Guthrie's report will appear in next issue.

The Growing of Saltbush.

During the hearing of Mrs. E. A. Tyson's application for an appraisement of rental by the Hay Land Board, the following evidence was called by the District Surveyor with a view of showing the possibilities of growing saltbush:—

Frank Albert Edward Fisher, of Booroorban, stated that he had been in the district since August, 1885, and his occupation since he had been in this district had been favourable to his acquiring a knowledge of the country. From that date, to January, 1902, he had travelled every four or five weeks, in the district between the Murrumbidgee and the Edwards, from Keri Keri on the west to Willurah on the east. He was the holder of a settlement lease on Wargam. About June, 1903, he started to cultivate saltbushes. He first cultivated 3 or 4 acres of ploughed ground, which before he ploughed it was stiff grey ground, partly wind-swept. He sowed that with saltbush seed and harrowed it once, sowing the seed as he harrowed it. That saltbush was now the best bit of perennial dwarf saltbush one could see. In six months after sowing he collected about 70 lb. of seed off the bushes, and he believed he could have collected 200 lbs. Later on in June, 1903, on a more windswept piece of country alongside he sowed saltbush without cultivating, except for running furrows about 10 yards apart on an average, but as he ploughed the furrows the wrong way (viz., the way the water ran) the water ran off and the furrows were of no use except to hold seeds. The ground was damp when he sowed the seed. He sowed the seed as he harrowed, but that harrowing was useless as it merely scratched the damp ground. One plant grew to about every three square yards. That saltbush grew splendidly, and was at present a picture. The saltbushes matured in about the same time as on the ploughed ground. On the same ground there were now thousands of self-sown plants, which had germinated from seeds which had dropped from the plants he had sown in June. The furrows he ploughed were thick with seedlings from one end to the other. The biggest of the bushes was about 3 ft. 6 in. across. There were hundreds of bushes 2 feet across. This year he harrowed some scalded patches, and had them sowed with seed. The bushes were now up, much too thick, as the seed had been sown too freely. He had specially treated in all, from 15 to 20 acres. The saltbush was now in perfect condition. There had not been stock on it. If he were sowing a large area he would sow about 2 lb. to the acre; 1 lb. would do if it could be well sown. It would cost about 1½d. per lb. to collect the seed in fair seasons. The best way to sow saltbush, in his opinion, would be to plough furrows 2 ft. 6 in. apart, 3 in. deep, sowing as one went. He estimated

that it would cost 1s. 6d. per acre. In this year's sowing, a boy with three horses, harrowed from 6 to 8 acres in a good half-day. The horses were slow. Parts of the area he had treated had been badly scalded patches. He knew the winds-wept country on Keri Keri and Tchelery. He believed that similar country could be successfully treated. The stock should be kept off for two seedings—from June to December for two years. The best months for sowing would be March and April, but seed could be sown from January to the end of June. Plants which germinated in May would seed in November; and those which germinated in June would seed in December.

The seeds would germinate in any year, excepting a year with a very dry winter, such as 1888, 1901, and 1902. For starting saltbushes he would prefer winter and spring rains; when they were established the summer rains would do most good in "freshening up" the saltbushes. He had good rains between Christmas and New Year. He had a wheat crop in, it was looking fairly well. He had a heavy rainfall about five weeks ago, and 40 points the other day. A rainfall of 10 inches would be sufficient to grow saltbush, but not ample. He believed the experience he had had this year would have been the experience of anyone else growing saltbush. Creeping saltbush grew exceptionally well on unstocked country last year. His own saltbush had been grown under normal conditions.

His method of gathering the seed was to put a bag around the bottom of a bush and shake the bush, when the seed fell down on to the bag.

The saltbushes fairly revelled in light soil. This year the winter had been exceptionally dry for the early part, and fairly good in July and August.

HOLSTEIN cattle are rapidly growing in favour throughout the State, and it is only a question of time when this breed will be one of the most popular with farmers having good dairy lands. A useful characteristic of the Holstein is that, though the cows are the heaviest of milkers and show no tendency to beef while as heifers or when in milk, they very quickly put on condition and make good butcher's beasts when they have finished their dairy career. The cross on to the Shorthorn also gives very fair steers. These cattle are becoming well-known on the Richmond and Tweed, where the Government-imported bulls have been leased for some years. The progeny of these animals are now milking, and the farmers speak very highly of them. Mr. Cornwell has just purchased the fine young Holstein bull, "United States," from the Government Stud Farm, which was advertised in a recent issue of the *Gazette*. He goes to the Richmond River.—M. A. O'CALLAGHAN.

The Sheep Maggot, with Notes on other Common Flies.

[Continued from Page 1211, Vol. xv.]

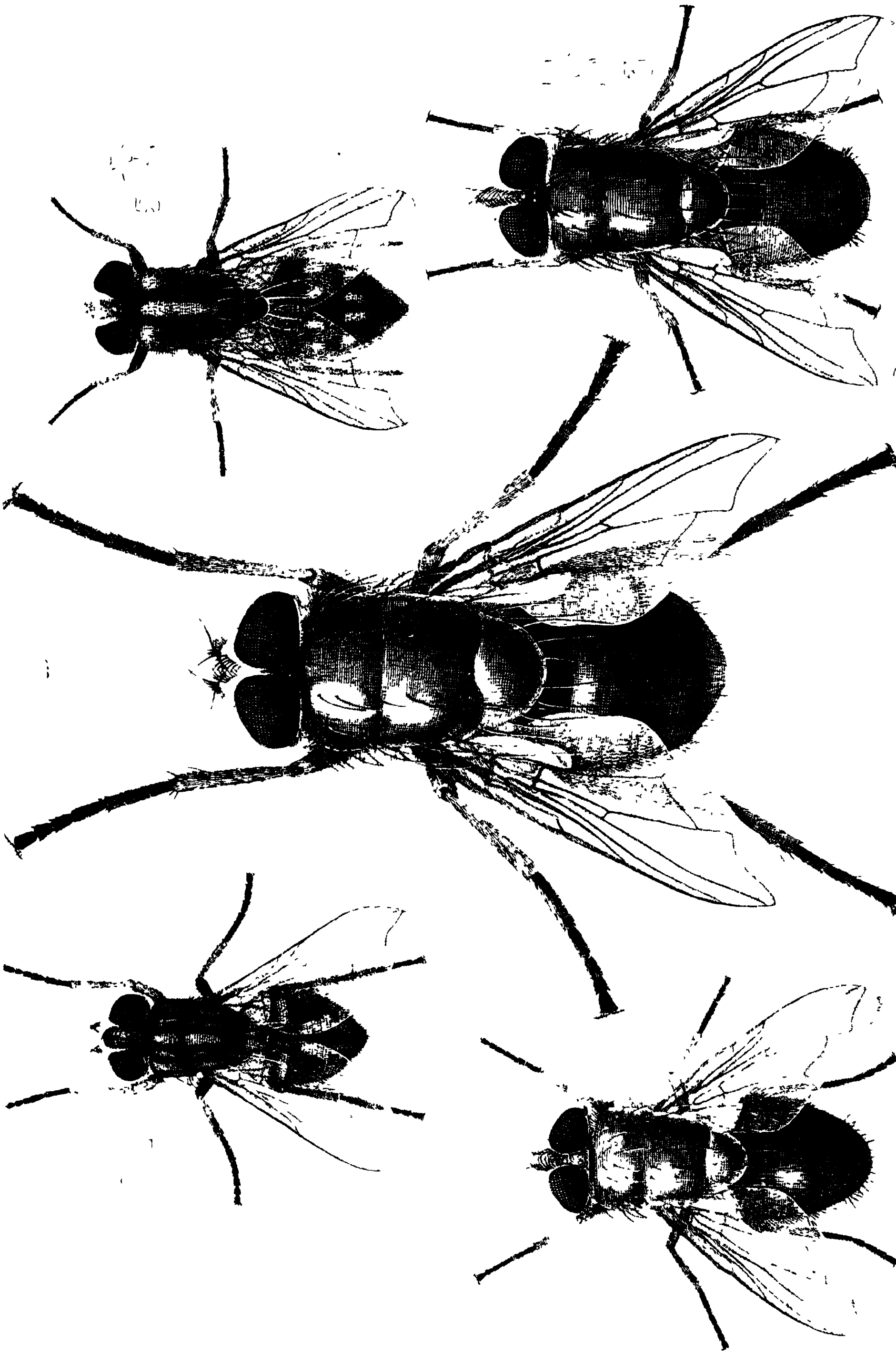
By WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

The Blue Bottle Fly (*Lucilia sericata*, Meigen).

[Fig. 3 of Plate.]

This is the well-known sheep fly in England, where it is said to be responsible for all the "blown sheep" in the United Kingdom; but some authorities consider that the allied species *Lucilia cæsar* also infests sheep and causes some of the damage. The members of the genus may be characterised as blue or green bottle flies, easily distinguished from the typical blow-fly by the generally smaller size and rich metallic tints, the space in front of the head being bare, which in the *Calliphora* (common blow-fly) is covered with fine hairs. This species is of moderate size, measuring 4 lines from the front of the head to the tip of the wings, and is of uniform rich metallic green colour, with coppery tints on the abdomen, and differs from other species of the genus in having the centre of the dorsal surface of the mesothorax furnished with three pairs of stout bristles, and the hairs or bristles on the third abdominal segment rather small and hidden by the long silken hairs. The female lays her eggs in clusters of about fifty in the wool of the sheep, well down in the fleece. These are about 1-16th of an inch in length, light yellow in colour. When examined under the microscope the surface of the egg is found to be covered with fine ridges, forming a network of angled areas. Ritzema Bos says that a single female can lay 500 eggs, which, within twenty-four hours after they are deposited, will develop into active maggots. The larva is of cylindrical form, with the cephalic (head) portion slender, furnished with a pair of curved black spines or jaws, and two spiracles (breathing tubes) projecting on the sides, each of which has ten little tubercles on ridges on the external margin. The body gradually thickens out to the last segment, which is somewhat flattened behind, forming a circular area or depression enclosing two apical orifices, each of which contains three keyhole-like openings; round this depression is a fringe of eight small and four larger tubercles, with the false or anal feet small.

The maggots are otherwise legless, their mode of progression being by means of the two mouth-hooks and a ridge of fine rasp-like spines around the centre of each segment, which by expanding and contracting the body, enables them to crawl quickly among the wool.



SHEEP FLIES AND HOUSE FLIES

Lucilia tasmaniensis,	No 1	*Musca domestica*	No 4
cæsar,	,, 2	*corvina*	5
,, *sericata*,	,, 3		

The maggots moult twice, and the pest remains in the larval stage about a fortnight, but their development is hastened or prolonged by weather conditions.

We have specimens of this fly bred from pupæ found among damaged wheat coming from Coolamon, N.S.W. It is widespread in England, and also recorded from France, Holland, and North America, but appears to do no damage in the latter country.

The Red Bottle Fly. (*Lucilia cæsar*, Linn.)

[Fig. 2 of Plate.]

This fly, like the former species, is common in Great Britain. Our specimens were collected in Southern Queensland; but it is probable that it will be found to have a wide range over Australia when our diptera are systematically collected. This species measures about one-third of an inch in length, and is of a uniform coppery green tint, which in some lights is quite a metallic red; the pubescence on the face very white; legs, down, and hairs black.

Theobald says that this species has been bred from blown wool; but it is probably very exceptional, for, as this fly has a very wide range, it would ere this have probably made itself felt in other parts of the world. It is recorded from Europe, has an extended range over North America, and is common in Australia.

The Large Blue Bottle Fly. (*Lucilia tasmanienis*, Macq.)

[Fig. 1 of Plate.]

These flies were collected in the vicinity of Brisbane. They measure just under half an inch in length, and are of a uniform bright metallic blue tint, brilliant and shining on the upper segments of the abdomen. Silvery pubescence round the eyes and front of the head, with the legs, bristles, and finer hairs black.

The Common House Fly. (*Musca domestica*, Linn.)

[Fig. 4 of Plate.]

The house fly was described by Linnæus in 1761, but, with the exception of the writings of De Geer and Bouché very little was known about it until many years after. To show how common things are neglected by collectors, when Dr. Packard wrote his prize essay upon the house fly in 1874, the question was raised as to whether the one found in American houses was identical with the common European species, for though popularly known under the name of *Musca domestica* up to that date, no one had ever taken the trouble to verify the matter. Lugger, in reference to this, says, "Strange to say, when the question arose in midwinter, all our museums were ransacked for specimens for comparison, and, to the great disgust of entomologists, it was discovered that not a single fly could be found in any American collection of insects."

This tiny creature has apparently followed man all over the world, and is now firmly established in almost every quarter of the globe.

Though Skuse states that it was found in this State, in his notes on the known Dipterous Fauna of Australia, read at the meeting of the Australian Association for the Advancement of Science, 1890, I can find no record of it having been actually identified until I submitted specimens to Mr. Coquellet, of the United States Entomological Division, last year. It was recorded by Kirk in New Zealand in 1896 as being very abundant, and, according to him, displacing the native flesh fly. It must, however, be borne in mind that every small fly found in our houses is not *Musca domestica*, as quite a number of different species may visit or take up their quarters in our homes in the summer time. Skuse says that fifteen species of the genus *Musca* are described from Australia. At night time the true *Musca domestica* can be easily separated from the other kinds from the fact that it always sleeps with its head downwards, while the others take the opposite attitude.

The life-history of this fly is now well known. Under natural conditions, she lays her eggs in fresh stable manure or rubbish, where there is a certain amount of both warmth and moisture. During the process of development, which averages about six days, the maggot moults twice; when full grown, contracting into a rounded oval pupa enclosed in a reddish-brown chrysalid case, in which it may remain for several weeks, or only a few days, according to the season; when ready to emerge it pushes off the tip of the chrysalid case and crawls out. Lugger watched one in captivity lay 120 eggs between the evening and the following morning, and it has been estimated that during the season one house fly will at intervals deposit upwards of a thousand eggs.

The house fly is one of the most aggravating pests that annoy man and domestic animals in the summer months in the neighbourhood of Sydney, but it is in the western towns and country in the interior that this pest flourishes, and swarms over everything, and renders fly nets a necessity. It is only natural that where sanitary conditions are so neglected as they are in so many of our country towns where you will often find an ill-kept stable within a few yards of the dining room window of a country hotel, that flies should multiply like they do; but it is very remarkable that right away in the bush, miles away from any habitation, the traveller will find them more plentiful than in the town. There seems to be no place where a fly could breed —surrounded with parched up plains and scrub extending for miles on every side, and not a drop of water—yet, from daylight till dark, one is enveloped in a cloud of flies. Most of the sandy blight, sore eyes, and wounds that will not heal, can be traced to the agency of the flies; and where sanitary arrangements are wanting they are responsible for the spread of typhoid fever and other serious diseases. Many a strong bushman has lost his life through an insignificant little house fly infecting an open wound with anthrax or other form of blood poisoning.

The house fly measures from the front of the head to the tips of the wings about ¼ of an inch, and may be described as a uniform black insect, but so thickly covered with grey tomentum, that it has a decidedly grey tint. The head, silvery in front, is furnished with

reddish brown eyes; the face and thorax clothed with stiff black bristles; four dark parallel bands give the upper surface of the thorax a striped appearance with silvery spaces between; and the abdomen is mottled all over with grey pubescence.

Flies can be kept out of houses with wire blinds, and where a window does not directly face a bright light an open meshed wire net placed outside on the window is said to be sufficient to keep any fly from entering by that window. Several preparations of Pyrethrum, Buhach, or Persian insect powder, all of which are made from the flower heads and stems of *Pyrethrum roseum* and *P. cinerariæfolium*, contain an oil which has a very deadly effect on all insect life. Scattered about on the window sill it will kill all flies that come in contact with it, and burnt in a closed room will also drive out or kill all the flies and mosquitoes.

Horses always bring flies about, except when the stable is kept perfectly clean, and all droppings covered over or lightly sprayed with kerosene oil.

The Smaller House Fly. (*Musca corvina*, Fabr.)

[Fig. 5 of Plate.]

A number of specimens of a house fly collected in the summer time at Narrabeen were identified by Coquelett as of this species. It is another cosmopolitan species, found in England, many parts of Europe, and North America. It is of a general blackish tint, with thick silvery pubescence all over the centre of the thorax, showing two dark parallel bands; the abdomen more elongate, and forming a somewhat rounded apex. In size it is somewhat smaller than the common house fly.

The Stable Fly. (*Stomoxys calcitrans*, Linn.)

This is another cosmopolitan fly, often mistaken for the common house-fly, but, if the mouth parts are examined, it can be easily distinguished by the shape and structure of the proboscis, which stands out in front of the head, and enables it to prick the skin before sucking up the blood, while that of the house fly rubs or licks up the food, and is not a blood-sucking apparatus. Another distinction is that the head is furnished with feathered antennæ. Though in size and general appearance it resembles the house fly, it can be separated if closely observed, particularly when biting, by the flattened form of the body. Its general colour is grey, the front portion of the thorax marked with four stripes, and the hind portion spotted; the abdomen with a brownish tint, and three somewhat indistinct spots on the third segment. The maggots breed in stables in the fresh manure, but can be distinguished from those of the domestic fly upon comparison by the different shape of the head, and the possession of three openings in the posterior spiracles instead of one. This, and not the house fly, is probably the one that causes the partial blindness of horses in the interior; old horses in particular suffer very much from the fly pest, the lids of the eyes swelling up and the corners becoming

raw and swollen. Many a bushman keeps his fly-net for his horse as carefully as his own.

The Tsetse fly (*Glossina morsitans*), so well known in South Africa from the mortality it causes among stock, is closely allied to this fly. It is somewhat remarkable that a fly belonging to the genus *Glossina* (otherwise peculiar to Africa) has been described from Australia by Bigot in the "Annals of the Entomological Society of France" in 1885, under the name of *Glossina ventricosa*. If such a fly exists in this country, it may some day appear among stock as a new plague to pastoralists. Some years ago an outbreak of malignant pustules on cattle in New Caledonia was said to have been caused by *Stomoxys calcitrans* and an undetermined species of another fly (genus Pangonia), the last a group of large flies well represented in Australia. Besides Europe, America, and Australia, Schiner records the stable fly from Hongkong, Ceylon, and Batavia.

There are a number of flies to be found in the bush belonging to closely allied families that can hardly be classed as pests, as they are parasitic upon the larvæ of moths, wasps, locusts, and other injurious insects, and the following have been bred, and identified in the Departmental collections :—

The Small Locust Fly (*Sarcophaga pachytyli*, Skuse.)

This is the smaller species of the several flies that have been bred out of the common plague locust (*Chortoicetes terminifera*). It was originally described by Skuse in the pages of this *Gazette* (1891, p. 256), under the name of *Musicera pachytyli*. These flies are found in the larval state in the abdomen of the locusts, from January to March, in the Wagga, Whitton, and Cooma districts, while two specimens of a closely allied species (if not identical) were bred from a solitary in-individual of the plague locust, taken by Mr. Gurney at Richmond.

The Golden-headed Fly (*Sarcophaga aurifrons*, Macquart.)

This is a larger and more common species that is plentiful in the bush, and found about pigsties or other evil-smelling localities. It can be easily recognised by the bright reddish eyes and golden pubescence over the front of the head, sides of thorax, fading into more silvery tints on the dorsal surface, enclosing three very distinct black parallel bars ; the abdomen mottled with silvery pubescence. Specimens in our collections from Queanbeyan, N.S.W., were bred out of the body of the same locust.

The Larger Locust Fly (*Tachina œdipoda*, Olliff.)

Olliff, in 1891, in a second paper in this *Gazette* (page 769) proposed the above name for this fly, which on careful comparison of the types with *S. aurifrons*, appears to only differ in the less golden colouration of the head and thorax, and less distinct busk on the upper surface. This fly was bred from the same species of locust in the same district.

The Native Silkworm Moth Fly (*Winthemia lata*, Macquart.)

This fly is common about New South Wales, and has been bred from a number of different hosts. It measures 5 lines to the tip of the body, stout in proportion, with the face silvery, eyes dark reddish brown, thorax lead colour, with indistinct black lines, legs and centre of dorsal surface of abdomen black, sides of abdominal segments and scutellum broadly margined with dull yellow, and the whole insect clothed with coarse black bristles, thickest on the sides of the thorax and tip of abdomen. The wings transparent, clouded at the base.

I have specimens bred from the pupae of the Native Silkworm Moth (*Antherœa eucalypti*), the small Bag Moth (*Ocinara Lewinæ*), and an undetermined specie of Hawk Moth.

Notes on Remedies for Blown Sheep.—In the first part of this paper it was stated that *Banol*, a mixture that was placed on the market, was a fish oil; it is, however, a mineral oil, with phenol and other materials added.

Mr. Blyth, manager of Gunnee Station, informs me that he has found sulphur and fish oil of very little value for treating lambs after tailing, and has gone back to Stockholm tar and sulphur alone. Of course the tailed lambs are very different from sheep with blown wool, and the old dressing of tar is probably the best in the cutting yard for lambs. I have had a number of sheep dips examined, and find the active properties of them consist either of sulphur and arsenic, or mineral oils containing some form of carbolic in combination. We are at present in the experimental stage as regards the best material for dressing blown sheep, and it can only be settled by experiments. I shall therefore be very glad to get any hints or suggestions that may be made by sheep-men who are interested in the matter, and have opportunities to make their own tests.

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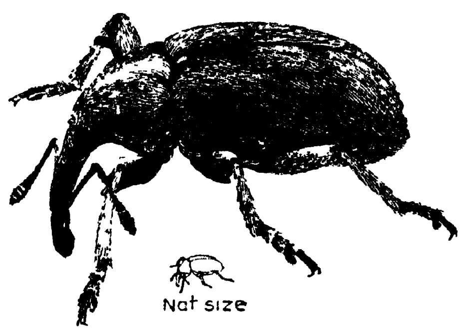
The Cotton-boll Weevil.

(*Anthonomus grandis*, Boh.)

A Cotton Pest that might be Introduced.

By WALTER W. FROGGATT, F.L.S.
Government Entomologist.

Now that a considerable amount of interest is being taken in the cultivation of cotton in the warmer portions of Australia, and the cotton plant is found to thrive on the northern rivers of this State, it is quite probable that new kinds of seed may be imported, and it behoves us to take care that no tiny pest like the cotton-boll weevil is introduced at the same time. This typical little weevil measures about ¼ of an inch in length, and when it first emerges is reddish-brown, covered with a yellowish bloom, but becomes of a uniform grayish tint when mature. The female punctures the flower buds and green bolls on the cotton plant with her sharp-toothed snout, then turns round and deposits an egg or eggs beneath the skin, for upwards of eleven larvæ and beetles have been taken from a single boll. The grubs as they hatch out burrow into the boll and feed upon the tissue, sometimes gnawing into the seeds, but usually pupating close to the inner surface of the shell or boll which holds the cotton. The infested buds and bolls never mature, but gradually wither and fall off, the larvæ, full grown, pupating and wintering inside the shelter of the boll. Townsend found that the beetles sometimes remained in the cracks in the ground and may thus hibernate through the winter. His investigations in Texas showed that if all damaged bolls were collected and the cotton-fields burnt over the pest was greatly diminished. This beetle was originally described by Boheman in Schoenherr's Genera and Species of Curculonidæ, published in 1843, from Veracrux, Mexico; it was first noticed as a pest in 1856 around Monclova, in the State of Coahula, Mexico, and was locally known there for some years before it commenced to spread northwards, and for six years it was so plentiful that cotton growing was abandoned. In 1893–5 it had spread all over the cotton growing belt of Southern Texas, into which State it was generally distributed by shipments of unginned cotton (cotton in the seed), and in some places it became so numerous that the weevils destroyed up to 90 per cent. of the crop. In 1894 the United States Department of Agriculture

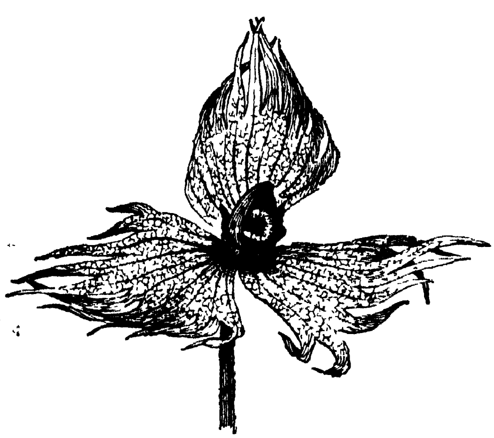


The Cotton-boll Weevil.

instructed C. H. Tyler Townsend to make a thorough investigation into the life-history and habits of this pest, which threatened the cotton-growers of all the adjoining States. His report, from which much of the above information has been condensed, was published in "Insect Life," vol. VII., p. 295, 1895. Since that date the state of things among the cotton-growers of Texas has not improved, and the work of the division of Entomology after several years experiments failed to have much effect upon its numbers. W. D. Hunter was appointed special agent in charge of cotton-boll weevil investigations, and the results of his experiments were published early this year in a "Farmer's Bulletin (No. 189)," entitled *Information concerning the Mexican Cotton-boll Weevil.* In this report he points out that though there appears to be very little hope of exterminating the weevil, yet by planting the cotton early and getting the varieties that mature early they can obtain much better results than in the late crops, while by good cultivation, planting the rows wide apart, and ploughing up and burning all the cotton stalks after the crop is gathered, the pest may be kept in check.

To show the extent of these investigations it is reported that 558 acres representing seven different fields in five regions of Texas were used for experimental purposes, and five entomologists were working at this pest.

This weevil cannot be imported into Australia in ginned seed as the process of cleaning the cotton would crush every seed in which a larva was hidden, but in cotton in the seed or dried bolls it could come into any country very easily, particularly in large shipments; therefore, it is advisable that all seed should be fumigated before it is planted. Saunders estimates that the loss caused by this weevil means 15 per cent. of the whole crop of the State, 3 per cent. of that of the United States, and in round numbers 2 per cent. of the world's production, with a cash value of 8,000,000 dollars (about £1,600,000).



The larva in a Cotton-boll.

The genus *Anthonomus* to which this beetle belongs is an extensive one, 100 different species being listed in Gemminger and Harold's Catalogue of the Coleoptera of the world, though half of these are peculiar to America, others have a wide range, and one species *Anthonomus australis* is described from Australia by Boisduval in the zoology of the voyage of the "Astrolabe," 1835. The genus contains quite a number of well known pests, a tiny black species (*Anthonomus signatus*) is well know as the strawberry weevil, and does a great deal of damage to this fruit in America. *Anthonomus nigrinus* attacks

potatoes and other solanaceous plants and *Anthonomus pomorum* is a pest to apple-growers.

Only one small hymenopterous parasite has been found infesting the larva of the cotton-boll weevil and it is not common, yet this pest has been known since 1843, and there is no question about Mexico being its original home, so that if the theory of the parasite entomologist holds good, there should be no difficulty in obtaining its natural enemy in its native land. About the middle of this year Mr. B. F. Cook, Botanist in charge of Investigations in Tropical Agriculture, in Bulletin No. 49, Bureau of Entomology, furnishes a "Report on the Habits of the Kelep or Guatemalan Cotton-boll Weevil Ant," which he has introduced into the Texan cotton-fields. He states that this ant (of which the scientific name is not given) has destroyed the boll weevil in certain parts of Guatemala so that it does not injure the cotton. According to his account it is a predaceous, stinging, burrowing ant, that both stings and dismembers the adult weevils, hunting over the cotton plants for its prey. This may be a great discovery, but we have had so many alleged parasites and insect enemies introduced, of which after their advent we have heard nothing more, that the man on the land waits for results. As an entomologist, the writer considers that it is a very serious thing to introduce a stinging tropical ant into another country, even if the results are as great as Mr. Cook anticipates. When these ants multiply and destroy all the weevils, where will they then go for their food? They will have to take to something else or die out. In Australia we have a genus of stinging ants (*Myrmecia*), which are commonly known as "bulldog ants," that can both sting and bite and are very serious trouble about a house. It is stated by Bates in his "Naturalist on the Amazon" that when "the fire ant" "Formigu de fugo" (*Myrmecia sævissima*) comes in at one end of the village the natives rush out at the other and leave the fire ants in possession. According to Professor Wheeler, Texas has a rich ant fauna of its own which can sting, and may object to outside competition.

In reference to the question of introducing tropical stinging ants into Texas, Circular No. 4 of the Porto Rico Agricultural Experimental Station, issued by F. D. Gardener, on "Control of the Brown Ant *Solenopsis geminata*, Fab.) in Orange Orchards," is very interesting reading. Gardener says: "Excepting the scale insects, the most serious pest at present affecting young orange trees in Porto Rico is the Brown, or Stinging Ant. It has already caused very serious damage to citrus stock in many localities, and unless immediate measures are taken to check its increase, greater loss will follow." The ants in their native state live in communities underground, number from five to 15,000, and feed upon small seeds, insects, and the secretions of scale insects. In hunting for the latter in the orange orchards they have found that the gummy excretion from the wounds in the bark was good to eat, so they make cuts in the bark with their jaws, bite the flowers, twigs, and young fruit to obtain it; nor is this the only damage, for, constantly nibbling on the edges of the incision, they cause the wound to spread, until it often extends round the twig or trunk and destroys the tree.

Useful Australian Plants.

BY J. H. MAIDEN,
Government Botanist and Director, Botanic Gardens, Sydney.

Eriachne.

Spikelets two-flowered, usually not very numerous, in a loose or dense panicle, the flowers both hemaphrodite and similar, the *rhachis* of the spikelet articulate above the outer glumes, and hairy round the flowering ones.
Empty glumes two, persistent, acute or tapering into a point or short awn, many (usually nine- to eleven-) nerved.
Flowering glumes with fewer nerves, with long spreading hairs on the back or margins, awnless or tapering into a fine straight or curved awn, not twisted.
Palea very flat, often hairy on the back, with two prominent almost marginal nerves.
Styles distinct, short.
Grain more or less flattened, enclosed in the glume and palea, free from them.
Fungi found on Eriachne.—*Sorosporium eriachnes*, Thun., and *Ustilago australis*, Cooke, have both been recorded from *Eriachne sp.*

No. 91. *Eriachne aristidea*, F.v.M.

Botanical names.—*Eriachne*—Greek, *erios*, wool; *achne*, chaff (glume), the glumes being woolly or hairy; *aristidea* resembling a grass of the genus *Aristida* in habit.

Botanical description.—(B.Fl., vii, 629) :—

Stems branching and often decumbent at the base, ascending to from ½ to 1½ feet, the nodes usually bearded
Leaves flat, glabrous, the sheaths often broad.
Panicle loose, with few spreading branches.
Spikelets shortly pedicellate.
Outer glumes usually purplish, about 4 lines long, acute, sprinkled with spreading hairs arising from tubercles.
Flowering glumes, densely silky-hairy, except at the top, tapering into an awn scarcely so long as the glume itself.
Palea hairy, tapering into a deeply bifid awn-like point

Value as a fodder not known. When in flower it is a distinctly ornamental species.

Habitat and Range.—Found in all the States, except Tasmania and Victoria. An interior species.

EXPLANATION OF PLATE.

A. Portion of panicle.
B. The two outer glumes.
C. The two-awned flowering glumes.
D. The palea.
E. The seed.

N.B.—The name of plate is spelled incorrectly—*Erachne* should read *Eriachne*.

ERACHNE ARISTIDEA

Botanical Notes.

By J. H. MAIDEN.

On Amsinckia intermedia, and some other Weeds.

In the proceedings of the Royal Society of New South Wales, vol. xxxvii (1903), p. xlii, occurred the following passage:—

"Mr. Maiden exhibited four bad weeds, not hitherto recorded for the State, which had come under his notice during the previous fortnight, viz.:—(1) *Amsinckia intermedia*, Fisch and Meyer, a yellow-flowered member of the Forget-me-not family, from Blayney. It is also a pest in California. (2) *Adonis autumnalis*, Linn., the Autumn Pheasant's Eye or Red Chamomile, a pretty plant belonging to the Buttercup family. It is a European plant, and comes from the Berrigan district. (3) *Lactuca scariola*, Linn., 'Prickly Lettuce,' from Barraba, a weed difficult to cope with because of its feathery seeds, and which he had already received from Aberdeen and Wollongbar in 1899. (4) *Sisymbrium orientale*, Linn., a weed belonging to the Mustard family and native of South Europe. This also hails from Barraba."

It is an oversight that the above weeds were not recorded in the *Agricultural Gazette*. The *Amsinckia* was reported upon from Blayney as a pest of the worst kind. It has now made its appearance in the Wagga Wagga district, and will no doubt travel over extensive areas in this State unless it is coped with. It should be very carefully pulled up when in flower (or before) and burnt, and by no means permitted to produce seed.

The Barley Grass.

[Previous reference, October, p. 922, vol. xv.]

A well-known pastoralist in the Barmedman district writes to the Government Botanist:—

"I have been much-interested in your article in this month's Government *Agricultural Gazette* on what is truly proving a pest—the Barley Grass. I have long held in opposition to many that it was a pest, and at the best of times of little value as fodder. Last year, probably, was our worst year with it. It infested every place, blinded the horses, cows, pigs, sheep, dogs, cats, and even the fowls. We have many now quite blind in one eye, to say nothing of the damage to the poor animals' mouths. We made two large stacks of wheaten hay, in which there was a certain quantity of the grass, and, after using some, had to destroy the bulk. When I came here twenty-five years ago there was just a little in some old yards—it was quite new to me—now there is not an acre out of 10,000 free from it, and in

many places there is nothing else, warranting the supposition that it will kill out many of our best grasses. Perhaps we feel it more in wheat paddocks, where it quite smothers the wheat. If at all thick, the only method of destroying it is ploughing up in the spring, when it has well germinated, but as for destroying or checking it in the grass paddocks, it is a hopeless and impossible task. I have been hoping that it might kill itself out like the Black Thistle, but I fear now it has come to say."

Sheep as an Adjunct to the Farm.

A few years ago it was a rare thing to see sheep on the ordinary small farm; cattle and pigs in almost every case, but no sheep. Even now they are not too common, and often one may meet a farmer who, if asked why he does not keep a few sheep, will answer, "Oh, they don't pay on a small scale." He forgets, however, that he must have meat; and if he possess a few sheep, this is ready to his hand at a much lower price than he would otherwise pay for it; and cured mutton hams for winter use are by no means to be despised. The skin, too, is always saleable according to growth, &c., of wool upon it, and the offal and bones are worth something, if only for manure. The sheep he does not need to kill are growing wool while he is sleeping; and the fat lambs from breeds that mature quickly are the fellows that make his profits swell; also, certain wheats, if sown early, are much benefited by feeding off with sheep, judiciously in the autumn and winter. The feeding will make them stool well, which is desirable, as less seed may be sown in moist districts, though, in dry districts, I think it is not desirable that wheats should stool too much, as the roots of one plant would be called on to supply too much nourishment to the many blades and ears. Still, if sown thickly, and inclined to grow rank, the crop is all the better if eaten off for a time. Wheat is very nutritious, and is especially good for weaners, also to top old ewes. Sheep manure the land, so in poor land the farmer is able, to a great extent, to save the expense of artificial manures. If grass-seed—Poverty Bay rye-grass, for instance—is intended to be sown with wheat for laying down pasture land, when the wheat is up it may be sown, and if heavily stocked with sheep they will tread it in, and to a great extent serve instead of harrowing, as these little seeds must not be covered too deeply. Sheep manure is, unlike some other manures, in a condition to benefit the land at once. Sheep keep down weeds on the farm, which, after cutting the crop, and at other times, come up and would seed and spread.

The two great sources of national wealth—sheep and wheat—may be grown on the same farm, and, with judgment, will certainly help each other to be more profitable to the farmer who grows them both.—R. H. Gennys—Experimental Farm, Glen Innes.

Bee-keeping on Farms.

ALBERT GALE.

I HAVE on many occasions in this *Gazette* discussed the various phases of bee-keeping as an industry. There is another aspect of the matter that I think is well worthy of attention, that is, the keeping of bees on farms and orchards primarily to supply domestic requirements, but also to provide a very suitable medium for the encouragement of the young folks to become interested in their home and its surroundings. It may be possible, of course, so long as the children can be so governed, to force upon them all sorts of minor duties that arise in connection with farm life, but how much more effective and long-lasting would be the results if all parents would take the trouble to encourage the little ones to take up various sections of the industry in the way, not of a task, but of a hobby. A great deal of invaluable work is being done throughout the State by our Public School teachers. Every child whose earnest interest can be aroused in the care of the little patch of school garden is the makings of a successful agriculturist. We can see, any day, men who fail to succeed at farming or fruit-growing, simply because they do not throw themselves heart and soul into their work. On the same class of land, and under the same climatic conditions, we may see men thriving and prosperous. Why? Because what to the man who does his work simply because it has to be done everything is an irksome task: to the man who makes a hobby of it, every job, big or little, is a labour of love, lightened by the interest and pleasure he takes in it.

As a man who has had much to do with the development of the faculties of country children, and who has seen as much as most men have of the inner life of the agriculturists of this State, I cannot too strongly emphasise the assertion that, if the children of to-day are to be the successful farmers of to-morrow, no pains must be spared to get them interested in hobbies.

Most people are, or should be, fond of hobbies. As a rule, very few, if any, of them pay, even for the first outlay, to say nothing of the expense of the upkeep of the said hobby, be it what it may. Nevertheless, there are many known cases where hobbies have been the nucleus or the foundation of thriving enterprises. Hobbies in subjects of natural history have been the starting point for many valuable scientific discoveries. They have taught many a one the value of self-help. There seems to be a magnetism about hobbies that draws people like-minded into closer fellowship: "A fellow feeling makes us wondrous kind." Poultry clubs, pigeon clubs, bee associations, horticultural and agricultural societies have all more or less sprung from persons who have become enthusiastic over hobbies.

Children brought up in the country have a longing for city life. Those brought up in the city desire a country life. To walk in the footsteps of your father is not always a safe rule, more especially when it refers to commercial footsteps. "What shall we do with our boys?" is the question asked in thousands of households. There appear now to be more openings for girls to make their own way in life than for boys, especially in cities and towns. The land is supposed to offer more congenial occupations for men and boys than for women and girls. This idea is one rather of imagination than of fact. There are scores of vocations suitable for the delicate touch of women. In the old country there is a guild of lady horticulturists under the name of the "Daughters of Ceres." Here is a cutting from a "Letter from London" that appeared recently in the Sydney *Daily Telegraph*: "On ordinary days these ladies go about in sun-hats, short skirts, big aprons with big pockets, and work as hard as any man. There are forty of them, and their present house, Studley Castle, was surrounded by a wilderness when they went to it a year ago. Now the wilderness is a little industrial centre, producing vegetables, butter, cheese, honey, and jam."

In the country districts of New South Wales we have thousands of acres of good land that are asking and crying aloud for occupants. In the City of Sydney we have thousands of men and women who could be comfortably and prosperously engaged in agricultural pursuits. When a family from the city goes out into the country to settle, the domestic food supply will naturally be of vital concern. In this *Gazette* there have already appeared many suggestions concerning the steps that might be taken to provide for fruit, vegetables, poultry, &c. I wish now to add some advice concerning bees as a source of wholesome food, and, what is no less important, a source of pleasure and interest that will be an important factor in the development of the faculties that make for success on the land. Lots of men have failed in their agricultural enterprise because of the inability of the family reared in the city to settle contentedly in an environment in which the individual is very often driven back entirely upon his own resources for the pastime and recreation that makes life endurable anywhere. The family that possesses in its number one youngster who will look after the poultry as a hobby, another who delights in vegetable growing, and another who will look after bees with loving care, will be sure of three luxuries that none but the wealthiest families in the city would be able to command.

Bees can gather in tons of honey from the natural flora. Nature has been very good to this State, which is thickly studded with herbage and timber trees that are honey bearers. I know that all honey produced by our native flora is not palatable to man, whatever it may be to the little insects that gather it; but, the amount that is not fit for domestic use as a luxury is not worth bothering about. For all practical purposes, it may be safely said that wherever a farmer can settle, if he takes the trouble to get a colony of bees, and to look after them, he will be sure of a good supply of honey.

There was a time in the history of this State, when the initiatory

germs of the honey industry began to develop and had grown sufficiently to produce profitable fruits, that bee-keepers got more than a living by the help of the bee, and if we believe the published reports in the daily and other papers the industry is a long way from being dead and buried. In suitable districts honey production is still on the increase. Of course, like other crops, the seasons cause it to fluctuate, and we have not always a stable market for the product.

Between ten and fifteen years ago people living in country districts were all agog making a little money by the help of the bee. The enthusiasm of the bee-keeping hobby was not confined to the country districts, it came into our towns and even into the suburbs of the metropolis.

At the time referred to, it was seen that the average weight of honey per hive in one district was 170 lb., and from another 181 lb., and that specially selected hives gave as much as 250 lb. per annum. I have now before me facts where bee-keepers at the time referred to made (and by report still make) from £200 to £300 a year by the help of the bee.

What steps should a person take to begin bee-keeping on a scale sufficiently large to supply domestic requirements? I would not recommend the beginner to attempt to look after more than one hive at first; after he or she has acquired some knowledge of the bees, the stock can of course be added to.

A modern bar-frame hive, with everthing complete, 1-lb. sections, &c., can be obtained for about 8s., and generally a colony of bees of a good strain can be purchased for a sovereign. In many districts, however, at swarming time, it is possible for the wary to capture a stray swarm. The hive can be stood on a stump or in some safe place facing the east, and will need to be examined from time to time to guard against the moth.

All that it is at first necessary to learn can be acquired in a few hours' observation of a practical bee-keeper at work, or even by perusal of the extensive series of articles which I have published in this gazette from time to time. I am always only too glad to show anyone who cares to visit my place how to prepare the hive and manage the inmates.

List of Dairy Factories in New South Wales.

Copies of the list of dairy factories, creameries, &c., in the State, revised to date, may be had on application to the Department of Agriculture.

The Culture of Fresh-water Fishes.

Notes regarding certain proposals by Mr. Albert Gale, in the *Agricultural Gazette.*

By H. C. DANNEVIG,
Superintendent, Fisheries Investigations and Fish Culture.

In accordance with the Board's instructions, I have inquired into certain proposals that have been submitted by Mr. A. Gale, regarding fresh-water fish culture.

These proposals have for their object the stocking of water-holes and ponds with suitable food fishes for the use of the proprietor or immediate neighbours who otherwise have difficulty in obtaining even an occasional dish of fresh fish. The suggestion is based upon the example set in other places, where private people have secured or produced quite a little "reserve" for themselves, and to their own advantage.

Mr. Gale's proposals are not in detail; for his views he has mainly referred me to a couple of articles by himself in the *Agricultural Gazette* for January and June of the year 1904. These articles I have closely examined, and they give an attractive picture of the result in view.

Regarding the means to the desired end, the following appear the main features:—

1. As most of the suitable pond fishes are herbivorous, it would, in the first instance, be necessary to place in barren waters a variety of suitable water-plants; these would also serve in a measure to protect the fish-eggs and young fry. (A great many of the permanent water holes are already abundantly supplied in this respect.)
2. To stock such "reserves" with fresh-water fish of different kinds, as varieties of Perch and Carp.
3. To depend for the maintenance of the supply upon natural reproduction.
4. To accelerate the natural increase by means of protection of the eggs and young fry until able to look after themselves.

The main object of these proposals is most excellent, and should commend itself to such settlers as have got water-holes and ponds at disposal. Mr. Gale has also indicated the proper course for these people to adopt, viz.: to obtain from the nearest river or lagoon a variety of "stock" as desired. Most valuable and suitable fishes for this purpose are found in most parts of the State, and are readily obtained. The common Perch of the eastern slopes (*Percalates colonorum*), the Yellow-belly (*Ctenolates ambiguus*), Macquarie's Perch

(*Macquaria australasica*), and other forms of the western waters are instances hereof. These fishes are excellent for the table; they attain a considerable size, and, being indigenous, they would succeed where others might fail. Aquatic plants for food and shelter may also, when required, be transferred without much trouble from one place to another. No technical training or skill is required for work as here indicated; it is simple in the extreme, and would furnish a most excellent and inexpensive hobby for young and old.

So far, Mr. Gale's references to these matters are commendable and practicable, but the man on the land would require ample time and indulgence of the enthusiast before anything to advantage could be done by him with the fishes' eggs and young fry. They had better be left alone, and would, under favourable conditions, go far to maintain a supply. Failing this, the stock might, at convenient times, be replenished with young specimens from the original source.

In the June number of the *Agricultural Gazette*, Mr. Gale has furnished an article illustrative of how a well-kept pond might appear "when in full bloom." The effort is very successful, and should go far to create the desired enthusiasm, but to avoid the possibility of misconception and disappointment, it is well to mention that some waters will be found less suitable than others. The counterpoise to Mr. Gale's illustration is the situation only too common after a few years of continuous drought. Many water holes are periodically dried out or reduced to such an extent as to exterminate all fish life, and, without re-stocking, such waters will remain barren as at present. Great satisfaction may, however, be attained during the normal and favourable periods, and the local people will, in most cases, be the best judges as to what waters are worth cultivating.

While Mr. Gale has made a most practical suggestion as to how the settler may obtain very desirable material for the stocking of ponds, &c., he also considers it of advantage that certain places should be specially arranged for the purpose of raising quantities of young fish for distribution, and by way of illustration he has indicated that various structures in existence or to be made in connection with the Prospect Hatchery would be most suitable. This is also very good, only the proposal means artificial fish culture on the most approved lines, and such as has now been carried on by the Department for many years with good results. It was decided some time ago that operations should be extended to various indigenous and foreign forms of desirable qualities; provision to this end has been made on the present year's Estimates, and with an ample and capable staff at its disposal, the Department is not likely to fail in its undertaking. Artificial fish culture is now resorted to in most countries as the most effective means for coping with a decreasing supply, and for the establishment of new forms. In this State the young fish have been distributed in suitable waters of a public (or national) character; no charge can thus be made. But for the Government to similarly treat the private ponds and water holes is probably unwarranted, and not customary. Arrangements are, however, frequently made by which anybody may obtain a desired quantity of fry or yearlings at cost price.

The Settler's Guide.

ROBERT KALESKI,
Bulli Ranges, Liverpool.

TOOLS.

ONE of the most important factors to any settler's or farmer's success, in working up a new place, is that he has a first-class set of tools; the next, that he knows how to keep them in first-class order when in use; and the next, again, that he knows *how to* use them. I have put the last condition there purposely, because a "botch" who has good tools, and thoroughly understands sharpening them, can turn out better work than a man good in the *use* of tools who cannot pick good ones, or keep them right for work. Of course, a man good with tools should know all about them; still, many do not. Having been born with a mania for tools and the use of them, which is increasing with age, naturally I have learnt a little about them. It is with the hope of teaching others less conversant a point or two that I am writing this article. To many these hints will be superfluous; to others they may teach a little. If it could be counted up, the amount of time and strength spent in this State bullocking with poor tools badly sharpened would be found to be very great, and, reckoned in the aggregate, is a heavy cash loss to the country. Therefore it behoves every man interested in tools to learn all he can about them.

In pursuit of this knowledge, we must start with the raw materials out of which tools are made, namely, iron, steel, and wood, then we can better understand the details of each tool. Also, we must take the material by which they are kept in order, namely, files and stone.

Iron.

This is originally a mineral, in the form of iron mixed with stone; this mineral is called ironstone. To convert it into the first stage of usable iron, namely, cast-iron, certain quantities of this ironstone, coal, and limestone are mixed together in large ovens, and being lit, the coal burns the ironstone and limestone. In burning it melts the ironstone, and the liquid iron then seizes on the limestone for a flux, and in this molten condition is run into moulds or pigs, hence it is called pig or cast-iron. In melting, it has absorbed a certain amount of carbon, or charcoal, out of the coal; this carbon, or charcoal, makes the iron brittle, that well known characteristic of cast-iron. Of late years a cast-iron without brittleness has come into use; this is called malleable cast. It is made by enclosing pieces of cast-iron in wrought-iron chests, and completely covering the pieces of cast-iron with iron oxide powder, that is a powder full of oxygen held in the iron dust.

These chests, full of this cast-iron and oxide powder, are then put in the furnace and *gradually heated* up to a red heat, which is kept up for a few days till the carbon in the pig-iron combines with the oxygen in the powder and escapes in the form of gas (carbonic acid gas, that is). *The metal left is now annealed, or slowly cooled, and is called malleable cast-iron*, or, in some cases, run steel. It is a very inferior substitute for wrought-iron, and is unfit for making into any respectable edge tools.

I said the carbon, or charcoal, in the cast-iron made it brittle. To the blacksmith this brittleness makes cast-iron of no use, as he cannot bend it or hammer it; therefore, for his use, the carbon has to be taken out of the cast-iron by a process of re-heating and working, when the iron loses its brittleness and becomes wrought-iron, that is iron which can be bent or hammered into any shape desired, when heated. It is also possible now to weld or join the iron as may be desired, by getting it up to such a heat that the fibres in both pieces are loose and open. This condition is indicated by the pieces requiring to be joined throwing out showers of little sparks when pulled out of the fire. If the pieces are now quickly laid on the anvil and properly hammered with a welding hammer, the fibres of both pieces become so inlocked into each other that the joined bar is now as strong as one whole piece. This process is called welding. It is of this wrought-iron that the parts of most tools which do not require a cutting edge are made. To get a cutting edge the material to be used must be of steel.

Steel.

Steel is simply wrought-iron with the carbon or charcoal replaced in it. It is not possible to make *true, good* steel direct out of the cast-iron; apparently the carbon requires to be thoroughly *worked* through the iron fibres to make good steel, or rather, we should say, that the iron fibres require working so that on re-melting the carbon may dissolve evenly and equally through it, and thus make a good steel, for the quality of steel varies according—(1) to the *amount* of carbon in it, (2) *the way* the carbon is put in it.

The finest and dearest steel is made by first melting the wrought-iron (surrounded in its box by powdered charcoal) in furnaces. In melting, the wrought-iron absorbs the carbon or charcoal, and thus becomes steel. In this stage it is called blistered steel. When cooled, it is broken up and again melted, this time in pots or crucibles, with a metal called manganese in small quantities dusted over the pieces. When this manganesed steel is cooled, it is then taken out and sold as crucible steel; this steel is the very best for making all edge tools.

The next quality is called open-hearth steel; it is a modification of the crucible process. By the open-hearth process, a great number of pots are heated at the same time in an open hearth. They are heated by gas instead of coke or charcoal. Instead of charcoal being put in with the wrought-iron, pig-iron is put in with malleable cast, thus both in material and method the process is inferior to the crucible method, and, of course, produces inferior steel.

The lowest grade is Bessemer steel, in which air is blown into the molten pig-iron through pipes running into the sides of the pot. The oxygen in the air burns out the carbon in the iron, and makes the iron into a sort of steel. In estimating the quality of the steel, we judge it by the carbon in it. One-hundredth per cent. of carbon, or 1 lb. to every 1,000 lb. of steel, is the ideal proportion for strength and toughness. Less than that and it is too soft; over that it is too hard and brittle. By the crucible method the carbon is evenly distributed and the quantity is just right. By the open-hearth method it is less even and in varying quantities. By the Bessemer process (cheap) the carbon is so uneven in quantity and distribution that large air-bubbles are found through it, rendering it practically useless for tool-making purposes.

But why is the quantity and distribution of this carbon so important in estimating the quality of the steel? For this reason, that the presence of this brittle charcoal or carbon enables the steel to be tempered, that is, made into any condition of hardness or toughness desired by the tool-maker. By getting the steel up to certain heats (plainly indicated by the colours the steel turns) and suddenly quenching it in water or oil as required, the tool-maker can make a tool with a cutting edge of whatever hardness the work it is required for needs. The more even the quantity and distribution of this carbon the better the cutting edge that can be worked up. Therefore, to get good tools they must be made of good steel. The following points must be remembered about the iron and steel in tools:—First, like wood, they are simply material made up of numbers of fine, elastic fibres, locked one into the other, and as a whole containing, like wood, a certain amount of elasticity, according as the metal is cast-iron, wrought-iron, or steel. In cast-iron this is very very little, in wrought-iron a little, and in steel, according to the carbon in it, from fair to high. It is owing to this elasticity that iron and steel shrink and become brittle in cold weather, and swell and soften in hot. Another point is that these metals depend mainly for their strength on their skin being kept unbroken. When this is fractured, the tool or wire will snap on any strain being put on it. Another is that they will rust if exposed to the weather; that is, the oxygen in the iron or steel combines with the water in the air and turns into what we call rust, otherwise oxide of iron. This rusting eats out the skin of the tool in places, thus weakening it. Another point to be remembered is that all steel contains a certain amount of sand or silica, which, again, gives the steel a certain brittleness, so that steel will break out if struck on stone or other very hard substances. Another point to remember is that in buying steel tools, the best is the cheapest in the long run, as when people give a good price for a good article it makes them careful of it, and they will endeavour to learn every point for using it to the best advantage. The modern mania for cheapness in tools is, in my opinion, mainly responsible for the fearful amount of slovenly work done nowadays, as the tools fit to do good work are now rarely met with. "The best is the cheapest" in all tools from my experience.

Bearing these points about iron and steel in mind, let us now consider the other raw material, namely, wood.

Wood.

This is, of course, the timber of certain trees dried or seasoned and cut into the various shapes required. These timbers, from a tool-user's point of view are—beech, ash, and box (English timbers), hickory and beech (N. American), lignum vitæ (C. America), and oak (forest and swamp), ironbark, spotted and grey gum, red cedar (colonial).

Beech (English) is a very hard wood, very close-grained and tough, mostly used for making planes, gauges, handles, saw-frames, and mallets. To the carpenter and cabinet-maker it is the most important of all the woods. As we get it in this country it is of two colours, red beech and white beech. They are both good the red being, if anything, the better; at the same time the best test of the quality is the weight—the heavier the better wood. The market is flooded at the present time with sap rubbish, coloured, so the buyer must be careful to see that the weight is there. The great point in beech wood is that it will not crumble or "chew" away, but wears out evenly and very slowly.

Ash is a very light, tough wood, of a whitey grey colour, and loose, open grain. It is almost impossible to break it, as it springs like whalebone. For this reason it makes the best handles.

Box is a light yellow wood, so dense and tough that it is almost everlasting. Being only a small tree, its use is mainly confined to tool handles, rules, and "slips" or guides for the grooving in moulding planes, and small mallets.

Hickory is a very light, almost white, wood, very dense and tough, and, if taken with the grain right, is equal to ash for handles, and is in some cases better, that is where the handle is liable to being hit and knocked, as with a pick, axe, or mattock. This banging is too severe for the softer timber of the ash. The second growth hickory is far the best.

Beech (American) is a reddish, and sometimes whitish, looking stuff. It is used for the same purpose as the English beech, but is much cheaper and inferior.

Lignum vitæ (or tree of life) is the hardest and heaviest wood in the world. The sap-wood is white, the true wood from deep brown to black. Its main uses are for block pulleys and mallets, for which it is unequalled.

Oak (forest and swamp).—This timber is too well known to need description. I have tried it in many ways and believe that, given a fair trial of good wood, well seasoned and prepared, it is equal, if not superior, to either ash or hickory for tool handles. For bullock yokes the swamp oak is perfection.

Ironbark (red or white).—I have tried this for planes, &c., but it was no good, however well seasoned and worked up, as it would always crumble or chew away in working. For mauls for splitting, and handles where strength is required, it has no equal.

Spotted and grey gum make first-class mallets if well seasoned. I have never tried them for planes, but think they would be the same as ironbark.

Red cedar.—Where a tough light plane is required, one made from a piece of old root or butt cedar is hard to beat. From their softness, however, they do not last long enough in constant use. For straight-edges, saw-frames, furniture, and plugs or chocks, cedar has no equal.

Points to be remembered in Wood.

Below see illustration of log cut across to show grain. The way all timber is formed is thus: The plant, or, rather, young sapling, at first consists of two parts, the heart (Fig. 1 H) and the sap-wood (Fig. 2 SW). The first year of growth the heartwood forms a ring of true timber outside it, as below. The next year another ring of true wood (T.W.) is formed, the next year another, and so on until the tree attains maturity. But after the first couple of rings have been formed,

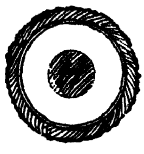


Fig. 1.

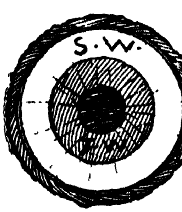


Fig. 2.

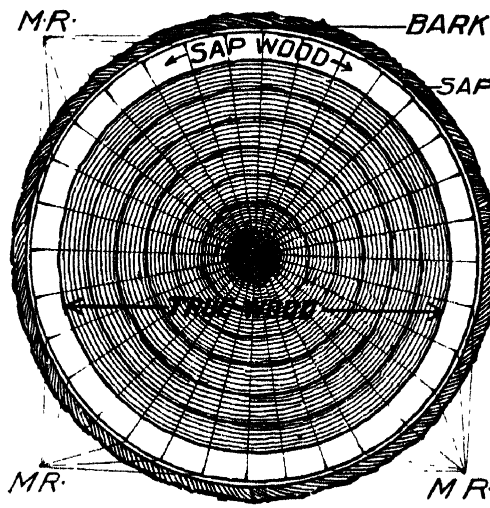


Fig. 3.

the heart or pith dries up to a mere string. The process of forming fresh rings then devolves on the sap or outside layer of wood. To make these fresh rings and keep a certain amount of sap circulating, like blood does through the human body, all through the tree, the sap-wood forces the sap through very fine openings in the rings right to the heart-wood. These little openings are called by botanists "the medullary rays," by carpenters and cabinet-makers "the silver grain," and by bushmen and splitters "the quarter," because by these rays the trunk can be split into quarters. If it were not for these medullary rays all timber would have to be sawn, as it would be impossible to split it. Fig. 3 shows a log-end in its proper dimensions. H is the heart, or pipe; then, the rings of true wood; then the sap-wood which feeds the lot; MR, which run from the sap-wood to the heart, like spokes of a wheel, are the medullary rays. Fig. 4 shows a *quarter* of the log. S is the sap-wood, TT the rings of true wood, H the heart,

MR the medullary rays. Throwing out the waste or soft wood (heart and sap), we get the quarter Fig. 5, "true wood" only. Now, as every bushman knows, when the log is quartered, and the waste backed off as shown, posts, rails, slabs, palings, and shingles are got by splitting at right angles to the quarter—that is, the rings are now split apart from each other by the wedges (the only exception to this is the oak *family, in which the medullary rays are so large and numerous that*

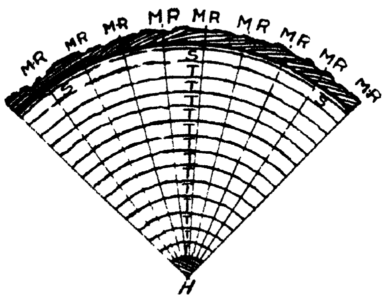


Fig. 4.

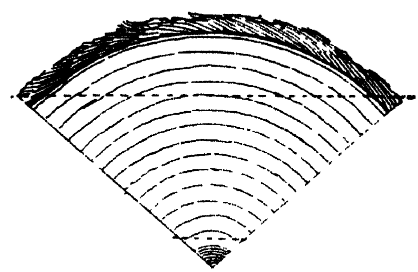


Fig. 5.

they will only split freely on the quarter, Figs. 7 and 8). The direction in which the timber splits is called the "grain." Thus we see that in all timber there are two grains—the medullary ray, or quartering, or silver grain, whichever you like to call it, dividing the log into quarters, and the grain of the rings lying at right angles to the quartering. This grain of the rings is called the backing-off or cross grain. Thus we can see for the surface of any plane to wear true and evenly its face or bed must be at right angles to the silver grain or medullary rays, as otherwise it must wear unevenly, several rings being worked at the same time, as shown. Fig. 9 shows the face or working surface of a plane, with the rings of true wood, and the medullary rays. If these rings were all of equal toughness it would not matter, but they vary in this according as the year in which each ring was grown was favourable or otherwise; also the rings nearest the sap and heart wood

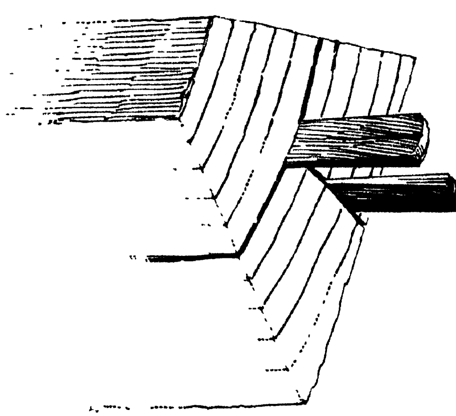


Fig. 6.

are softer than those furthest from them. Thus, if a soft ring and a tough ring are being worked on the one face, the soft one wears away faster than the tough one, and the face or bed of the plane is always high on the one side and low on the other, Fig 10; and boards planed by this plane will always have an uneven surface instead of being level, unless the face is kept shot up true, which, of course, soon wears the plane out. Thus we can understand why all planes should be picked

with the silver grain or medullary rays at right angles to the wearing surface. If all trees grew their grain straight there would be no need to say this; but as for every tree with a perfectly straight grain there are perhaps twenty twisted or crooked, it will be seen that as they

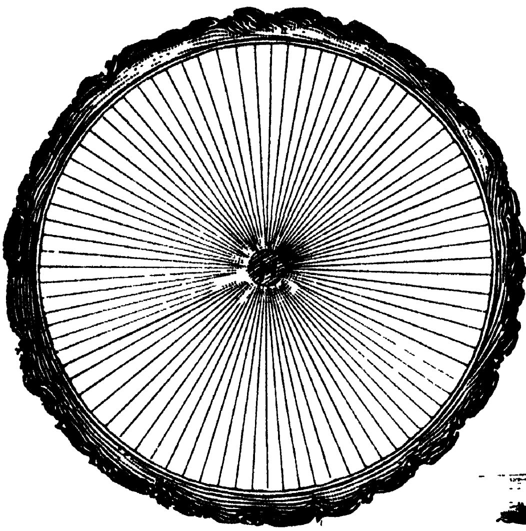


Fig. 7.

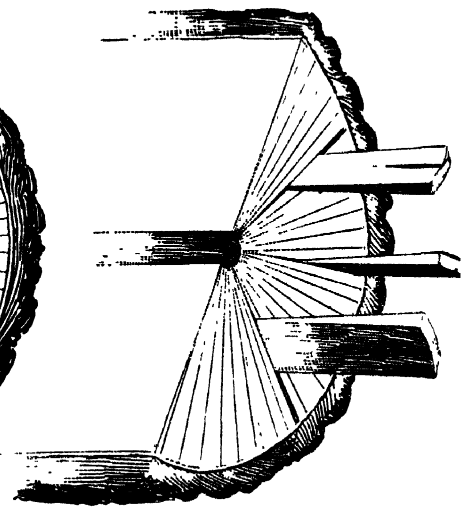


Fig. 8.

cannot be *split* into straight lengths they must be *sawn* so; but by being *sawn* straight, as shown, the grain is cut across, and the medullary rays then lie at all angles to the working surface.

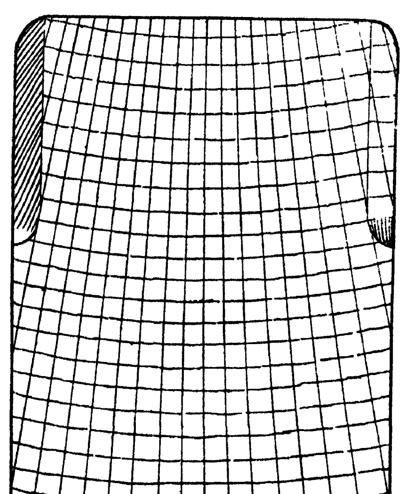


Fig. 9.

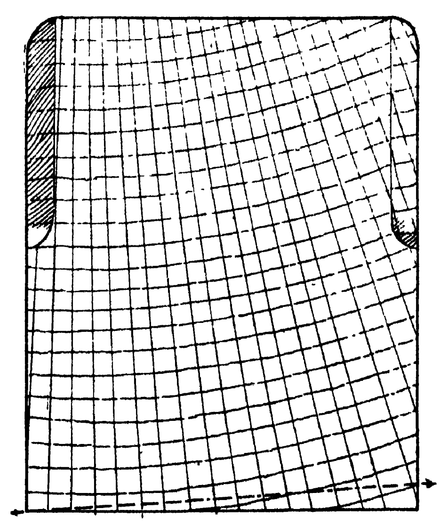


Fig 10.

In all tool handles, instead of lying at right angles to the face, the silver grain should lie at right angles to the tool point. See Fig. 11.

Why is this? For two reasons. In the first place, all timber is much harder to break at the right angles to the rings, than the parallel way of them, Fig. 12 and 13: In the second place, when *sawn out* and shaped, generally the grain lies across the direction of the handle Fig. 14. This renders it very liable to open across at the point shown, when any strain is put on it. Also, when sawn out of crooked timber, the grains of half-a-dozen rings, with their varying strengths, are in the one handle, making the strength of the whole very unequal. On the other hand, look at this handle with the silver grain or quartering, as I prefer to call it, at right angles to the tool point (Fig. 15).

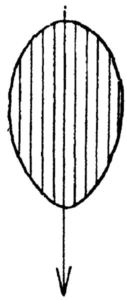


Fig. 11.

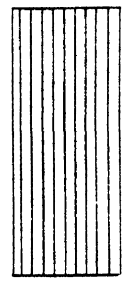


Fig. 12.

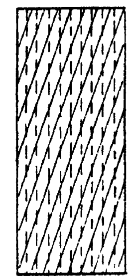


Fig. 13.

Here we have only one grain, the quartering lying at right angles to the tool point, and the rings parallel. Thus, as the cross-grain points the same way as the tool point, it is of equal strength in the handle; it will only break on the flat, and only then if greatly misused. It can split, certainly, but in practice very rarely does so, the average being about 1 in 300.

Thus in selecting all wooden planes or face tools, see that the silver grain or quartering is at right angles to the face to be worked. In selecting all tool-handles, see that the silver grain or quartering is at right angles to the tool point. Now, as to the preservation of the wood in handles or tools. It must be remembered that wood, in its natural green state, is really a collection of woody strings or fibres,

Fig. 14.

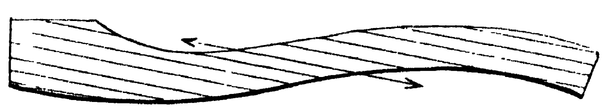
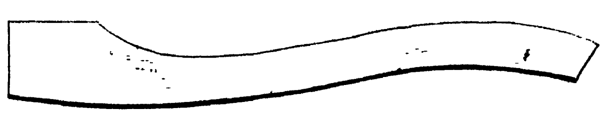


Fig. 15.



inlocked into one another in varying lengths and toughness, according to the different kinds of trees, and with sap or plant-blood circulating through and up and down these fibres by a chemical process called osmosis. This osmosis is really filtering, just as water filters through stone. (It may be news to some people that stones, like granite and basalt, always contain a certain amount of water.) Now, when the wood is dried and cut up, of course, it loses its sap. The fibres, not being fed, become dry and hard, shrink in size, and lose the elasticity which the moving sap gave them. But the openings through which the sap filtered are still there, and when the air becomes moist, as in wet weather, then the moisture enters these pores or openings, and

the wood then swells and becomes elastic. Should steam enter these pores instead, by reason of its heat and greater penetration, the wood becomes quite flexible, and some timbers can be bent into any shape desired by the artificer or wheelwright. If hot weather follows the moist, the heat dries out the moisture again, the fibres shrink still closer together than before, with the result that they divide into sections, and we say then that the sun is cracking or splitting the timber. In course of time, according to the nature and grain of the wood, these pores close up entirely; we say then that the wood is seasoned—that is, it has got past being able to shrink or swell with the changes of weather—and is fit for use. If we try to work it green (or sappy) it will shrink, buckle, and split, and spoil our work. But in exchange for this seasoning, we lose the elasticity which we require to find in wood for some uses, particularly in planes and handles. Is there any means by which we can regain this elasticity ?

The easiest way in the world. By soaking or dressing the wood in oil, grease, or fat (they are all the same, only some are vegetable fats, and others animal), the pores will open and admit the oil; if given sufficient time every fibre will absorb all the oil it needs, and will retain it too, on the bull-dog principle. When full up, the oil at the mouths of the pores will make a skin over them, and the timber can stand being left in water for a month without injury, as, like a popular matinee, there is no room inside! Of course, the oil repels the water like a poor relation, and it can get no chance to enter. The proper way to oil each tool and handle will be dealt with in describing it.

We can now understand that to keep wooden tools and handles in proper order, we must, before using them, oil them thoroughly, and they will stand far more and work far easier than if we do not, as the oiling gives them the "spring" or elasticity which makes the ease in working.

Having gained some slight idea as to the material out of which tools are made, let us consider them in detail. From a farmer's and settler's point of view, we may divide these into two classes—*bush* tools and *bench* tools.

In *bush* tools we have a cross-cut saw, axe, maul, wedges, adze, tomahawk, throw, auger, bar, spade, hoe, mattock, pick, block and tackle, straight-edges, grindstone, axestone, tape and line, and cant-hook. (The pitsaw is omitted, as, to do it justice, it must go under a separate chapter.)

In *bench* tools we have handsaws, planes, bevel, square, gauges, rule, chisels, mallet, brace, bits, oilstone, slips, grindstone, spokeshave, wood-rasp, bench axe. Taking them in order, we start with—

Cross-cut Saws.

The parts of these are :—The teeth, or cutting edge, the back, and the lugs or handle sockets, one at each end. The greatest depth is in the centre, and the least next the lugs. In length, these saws run from 3 ft. 6 in. to 7 ft. There are three sorts—the "Lightning," the "Lumberman" (both Disston's make), and the wide and close-spaced

"Peg-tooth." For general all-round use, the wide-spaced "Peg-tooth" is the best, as it cuts fast and easy, and is easily sharpened and kept in order. For fine work, especially in dry timber, the "Lightning" is the best, whilst the "Lumberman" stands midway between the two. (I

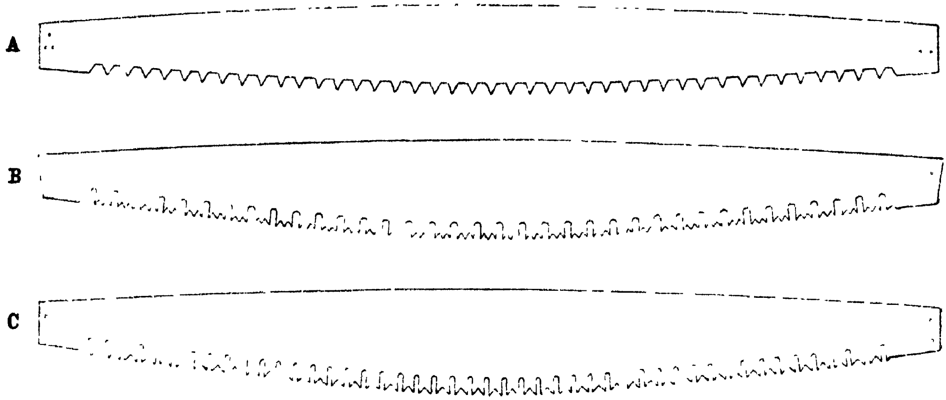


Fig. 16.—A. Peg-tooth; B. Lightning; C. Lumberman.

have, however, made a great improvement in the "Lumberman" I am using at present by breaking out every second stand of points (see fig. 21), and believe she cuts faster now than either my "Lightning" or "Peg-tooth." It may not be out of place to observe here that lots of people run away with the idea that the more teeth a saw has the faster she cuts, but this is a great mistake.) The drawback to both the "Lightning" and "Lumberman" is the care and time they take to sharpen as compared with a "Peg-tooth"; many bushmen cannot keep them properly, and condemn them on this account. The best all-round size is the 6-foot; smaller than that they are too short for fair-sized timber, and if longer are too whippy for one man to use. In extra big timber a 6 ft. 6 in. is necessary, but this is so rarely met with now that it does not pay a man to get one that size unless working in a patch of it.

In picking a saw, hold it up clear of everything with one hand, and ring the blade with the other. It will hum where your knuckles hit it according to the temper and quantity of carbon in the blade. The longer it hums or vibrates the better the quality of the steel. Then look down the teeth from end to end to see that the blade is straight, and look along on the flat of both sides to see that it is not "bumpy"—that is, hollow in some places and full in others. This is a great drawback to a saw, as it pulls hard through the full spots or bumps, knocking against the cut ends as it runs through the log. It is a fault very hard to detect in a new saw, in an old one very easy, as the bumps show bright and polished from knocking, and the hollows dull from escaping the friction. See that the saw is not too thick, or it wastes too much strength to saw with it. There are a large number of cheap saws on the market, which seem to be made out of a mixture of tin and lead, and to cut at all are made very thick; avoid these as a

pestilence. Personally, the only brand I use is Disston's; they are Yankee saws, nearly always good steel, well tempered and shaped, and wear very well—far better than any English saw I have used. The one-man wooden-handled saws are right enough for very small timber, but do not pay a bushman. I generally keep two saws, a 6-foot "Lumberman" or "Peg-tooth," and a 5-foot "Lightning" for shed building or fine work.

Care and Keeping a Cross-cut.—In the first place, always keep your saw well greased all over. This makes it run easier, and prevents the acid in the sap from eating out the softer parts of it and making it bumpy. Never let it get rusty, as it pulls much harder. In carrying it about always hold it in the centre, and on the shoulder; in laying it down when in use never leave it in the sun, but lay it under a bush, with the tooth-points well away from stones. If a saw is too soft, sell it and buy another one; if too hard, lay it on an iron roof in the sun for a few hours, when the heat will let the temper down. A saw too hard is a nuisance, because you cannot set or gullet it properly, and it wears out too many files. In sawing always make careful provision that the tree or log cannot "pinch" the saw, as it not only bends the teeth about, but "buckles" the saw—that is, twists the blade out of shape. A "buckled" saw will never saw straight; if turned in the cut when half-way through, as is the only way to do, one of the log ends will be hollow, and the other full, thus the lengths of palings, shingles, or any split stuff will be uneven. The saw can be hammered straight again by a good man, but it is always doubtful. Always put a wedge (fine-tapered) in behind the saw as soon as the saw-back will clear it. This stops the tree coming back and pinching it. Always have thumb-screws at one end at least to hold the lugs on, as, should the saw pinch, the lug can be taken off in a few seconds, and the log levered up so that the blade can be slipped out. A cross-cut cuts from the centre to each end, and with its own weight, so that each man should only pull his end to him. If sawing by himself, he must, of course, both pull and push. New-chums nearly always pull their end downwards, under the idea that the saw cuts that way; this makes the sawing much harder. To cure them of this, bear hard on your end as they are pulling their's to them. In five minutes you will have them with their tongue out. This is a certain and everlasting cure.

Fig. 16a.

Sharpening and Setting.—After a saw gets a bit of use, like all edge tools, it gets dull, and requires sharpening and setting. This is commonly called keeping a saw. Very few men can keep a saw properly; like many other things, it is the simplest thing in the world when you know how. In the first place, let us see how a cross-cut

does its work. By its shape, its greatest cut is at its centre, the width of the blade gradually lessening to each end. We find that the saw-teeth are placed at regular intervals along the blade; we also find that each tooth cuts with its point, and about a quarter of an inch below it. This point stands out a little from the straight line of the teeth; it is bent so by the sharpener, and the angle at which it stands

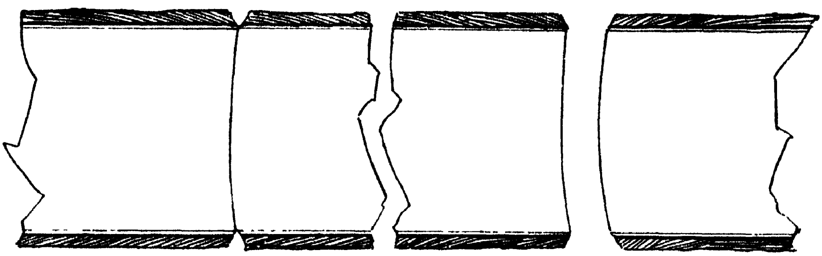


Fig. 16b.—The effect of using a buckled saw.

out is called the "set." In a properly set saw we see that each point is exactly in line with its neighbour on that side (these points are set out alternately from each side), and that the tops of the points are all in one even curved line. The reason for this is that each point must run in the same track, each point cutting the wood fibre a little deeper than its neighbour till it is severed. If the teeth-points are uneven either way, then the teeth-points out, instead of cutting the same fibre, are cutting one on the side, doing useless work, and making the saw much harder to pull. The particles of fibre severed by the teeth-points are called sawdust; these particles accumulate in the spaces between the teeth, called "gullets," and are drawn out clear of the cut by the bottom edge of the tooth. Now, if all timber fibres were alike, it would only be necessary to sharpen the saw one way, and to give it the one set. As, however, no two timbers cut alike, it is necessary that the saw shall be sharpened and set to suit whatever timber you are generally cutting. A saw sharpened and set for pine, for example, is useless to cut dry iron-bark with. The sharpener, therefore, must bear in mind that he must exercise whatever of that hard sense, miscalled "common," he possesses, and suit the teeth and set of his saw to the class of timber he is working. To do this, remember the softer the timber the *wider* the set, and the harder the timber the *narrower* the set. With respect to the shape of the tooth, there are two sorts—the needle-tooth (a long, very narrow tooth, Fig. 17), and the chisel-tooth (a square-pointed tooth, Fig. 18). Of the two, for working in all timbers, I never use anything myself but the needle-tooth, as I believe it gives the best results as to speed, ease, and keeping its edge.

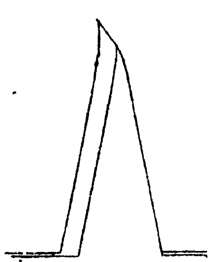


Fig. 17.

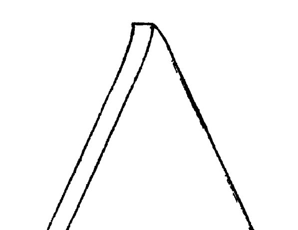


Fig. 18.

Plenty of the old hands swear by the chisel-tooth for working dry timber, however, but I think that is because they have never sharpened the needle-tooth properly to give it a fair trial. As the fibres in the softer timbers generally run long when cut into sawdust, they do not pull out freely, and often choke up the gullets. To remedy this, file every sixth or eighth tooth square across at right angles to the blade. These teeth will drag the sawdust out. For this reason they are called "drag-teeth."

Thus we see that the sharpener must not only keep his teeth-points and set true, but must also keep his saw as the timber he is to cut requires it. The great thing to remember in sharpening and setting is that it is all a question of angle. It is hardly necessary to remark that each tooth is worked on the opposite side to the one adjoining it, right along the blade.

Now for the actual sharpening:—The first thing to do is to put the saw into a vice to hold it steady. In sharpening at home, the best vice is made by putting up three dry posts, about 1 foot in diameter, in line, about 2 feet apart. Sink 3 feet in ground, and brace with two battens or saplings. Cut off the tops square, the height of your elbow

Fig. 19.—(The saw shown is prepared for renovation.)

from the ground. Lay a straight-edge across the centres of the posts, or line through the centre with string and chalk, and with the rip-saw cut a reef straight down, full in the centre post and less at the end ones, to fit the shape of the saw. If properly cut, the saw, when

dropped in, will be as straight and rigid as in a steel vice. Be careful to place the posts in a level spot, or you will sharpen one side higher than the other; also be careful to put it under cover, so that you can sharpen in wet weather. As a matter of fact, on any place a shed should be put up specially for tools and a workshop, and should be used for nothing else. If out in the bush, find two dry sapling stumps in line, split them down with the axe, slip a chip in for a wedge, and

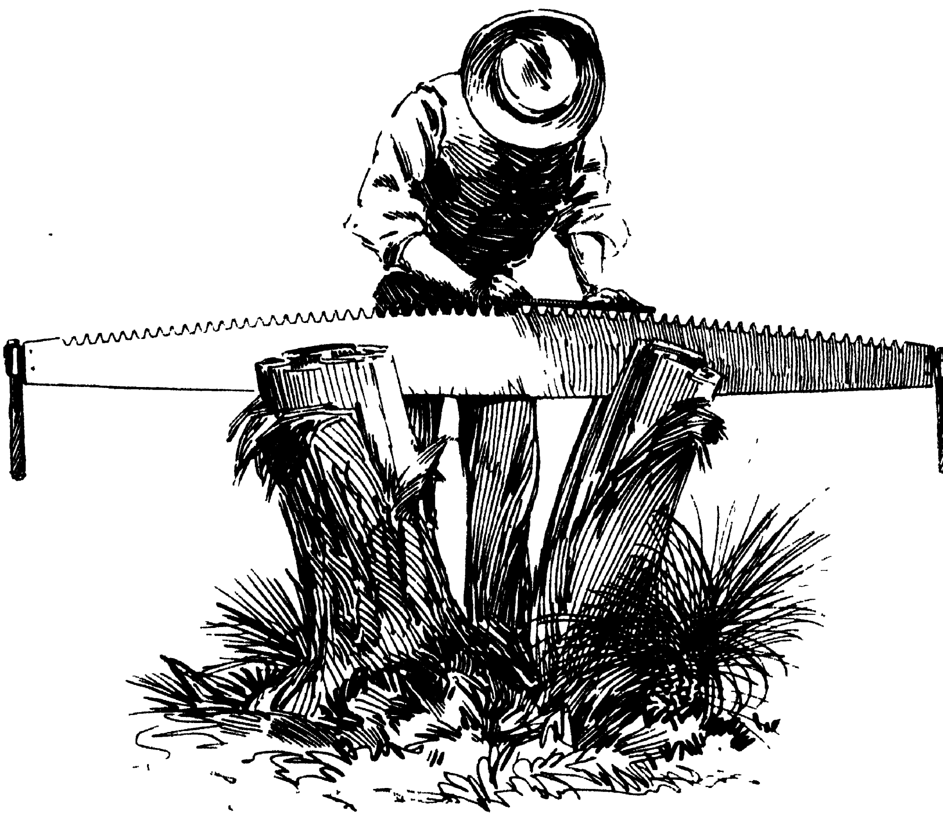


Fig. 20.

drop the saw into the opening. The ordinary bush practice of splitting two green sapling stumps is bad, because the acid in the sap eats into any soft spots in the blade, and makes it bumpy.

The first thing to do, the saw in the vice, is to top the teeth down level for a guide. To do this take an unhandled flat file, the longer the better, and, starting from the centre, run the file in a straight line back to each handle. Only use the file with a forward cut, as all files now are made with their edges set forward to cut that way only. (The English files, called "Stubbs's," were made to cut both ways, like a rule, but this to and from filing spoils the edge of the tooth). *Top down till the lowest tooth in the saw has its tip filed flat, and use the one stroke only from start to finish.* Now with a Morrill's saw-set set the teeth to the width you want. If you set *after* sharpening, the saw-set will knock all the points off the teeth. This Morrill's set is

the only absolutely true set in the market at present. An old sharpener can set with anything from two wedges up, but it requires constant practice to be able to do this. In buying a Morrill's, get the shopman to show you how it works. In setting in any way, bend the tooth at the point only; if you bend from down near the heel of the tooth, as soon as the point wears up, it will catch on there (the heel) as it runs through, and take two men's strength to pull it. In filing a peg, tooth up, start in the centre, and file every second tooth, (those pointing away from you) equally on both sides till you have brought it down to a fine point. Be careful to file, nearly at right angles to the blade, each side for a needle point, and almost square across for a chisel point. Also be careful to file each tooth at the same angle right through. If for soft timber, file every sixth tooth square across with the needle point. This is for a drag-tooth. You file with a flat file only, of course. The K and F files are about the best in the market at the present time, though Disstons and Nicholson's are not bad.

To sharpen a Lightning or Lumberman is more complicated. First top down, as with a peg-tooth; then set; then with a sharp flat file, file the points on the *gullet* side half up, keeping the file side nearly upright, so that it sharpens nearly from the gullet; then with a 6-in. three-cornered file sharpen the points from the inside, being careful to stop filing the second the point is *up*. File the heel of the tooth first, and the tip last. By suiting the angle, you can sharpen either chisel or needle-tooth. In all crosscuts sharpen one side right through before starting on the other side. With respect to the gullets, these should be kept deep in any crosscut to allow of easy sharpening and to let the sawdust work out. In a Lightning, they should be filed out with a gulleting file, or the round edge of a flat file; ditto in a Lumberman, if all the teeth are left in. If broken

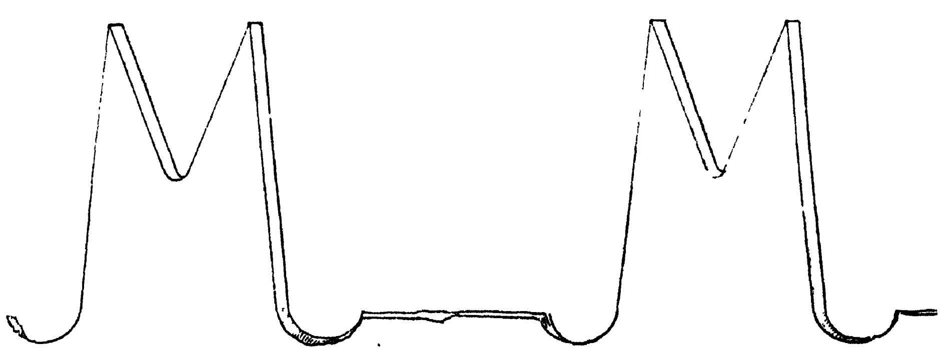


Fig. 21.

out, gullet the same way as a peg tooth, that is, break them out with a common set or a piece of iron or steel (flat) with a nick cut in it. (An old rasp makes a beauty.) See that the blade is held very firm and rigid whilst doing this, or you may buckle her. If of bad steel she will break out, like the plague, in spots. To get over this, nick the skin of the steel with a sharp file in the places you want her to break, and she will snap there accordingly.

Axes.

These may be divided into chopping or wood axes, mortising axes, wedge or splitting axes, side or squaring axes.

Chopping Axe.—This axe may be divided into three parts, the cutting edge, the eye or handle hole, and the back or poll. Except in all-steel axes, the edge only is of steel, the eye and poll being of iron and the cutting edge welded into it. Now, in the way this is welded, as well as in the temper and quality of the steel, is the difference between a good axe and a bad one. In a cheap axe, the iron part is shaped thus, Fig. 22, and the steel edge is split at the back, and lapped over the iron point. The result is, that once past the point, where the iron front touches the steel back, the axe has steel sides but an iron point or edge, which, of course, makes it useless when half worn out. This is called an overcoat axe, and as steel is worth about 9d. a pound and iron about 2d., can be sold cheap. The good, fair-priced axe on the other hand has the front of the iron split, and the steel back of the cutting edge dovetailed into it, Fig. 23. Thus it can be used even when ground back nearly to the eye, as though the sides are iron the edge is steel. It is easy to tell the difference in the two sorts; looking at an overcoat axe you can see that the line, where the iron and steel meet on the face, is close up to the eye as shown. A dovetailed axe on the other hand has the meeting line much nearer the cutting edge. Most new cheap axes have an imaginary line, where the japanning on them stops on the blade to deceive the unwary. Therefore, do not take any notice of the flat, but look closely at the top and bottom of the blade, when the line of the lap can usually be clearly seen. The only two axes on the market I ever use myself are the Collins and Kelly. The first are perfection but for the shoulder of the blade being too thick; the Kelly's are nice thin-shouldered axes, but too broad in the blade, and are nearly always badly tempered, being hard on the point and softening from their every grinding, till on being worn back a bit the edge will turn round and look at you if you show it a bit of hardwood. For my falling axe I never use anything but a Collins. They are dovetailed axes, beautifully balanced, and one will outwear three Kelly's or ordinary axes. The only place I have been able to get them so far is at Lassetters. (I do not believe in giving cheap advertisements, but mention brands of tools and places to get them at for other tool user's benefit.)

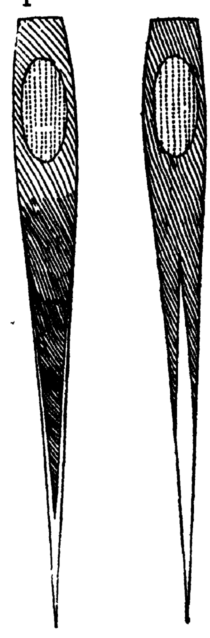


Fig. 22. Fig. 23.

The essential points in a good axe are (1) Good quality of steel in blade, and well and evenly tempered; (2) Proper shape in the blade so as to get the best results for the force used; (3) the poll or back to be smooth and made of the right weight, so that the

balance of the axe is right when swinging; (4) The weight of the axe to be in proper proportion to the work and user; (5) that the blade is fitted with a suitable handle. Now for the best way to get these points in their order:—

(1.) The only way to insure this is to buy one with a reliable brand, or get a skilful smith to make one. I try every axe on the market, but the only two I care to use are either Collins or the black Kelly, the Collins for choice.

(2) The shape shown in Fig. 24 is what I always use, because I believe it to be closest to the ideal. The other shapes shown are common faults in the ordinary cheap axes, and sometimes occur in both Collins and Kelly's. Why so? Because when the blades are too broad on the edge as shown, especially at the bottom, when chopped into soft wood, the back timber in the cut closes behind the blade, and the user loses a lot of strength pulling it out again. A scrub-faller's axe always advertises this fault, if it has it, by the handle being twisted half round where the user has been wrenching the chip out. On the other hand, in hard timber the wide peel stops the blade entering, causes great waste of force, nearly jars the arm off the user, and helps to crack the handle. Fortunately, this shaped axe soon breaks; the heel gaps out, taking about a quarter of the face with it as a rule, and the user can then have a spell by trotting back to the store and buying another. This is a splendid axe for the struggling storekeeper with no opposition, to sell. That is why I prefer the Collins to the Kelly, even when it is this objectionable battle-axe shape. This big Collins will very rarely fly, though a cruel axe to work in any but small green timber; the big Kelly, on the other hand, must have this heel ground down, or a hundred to one it will fly in

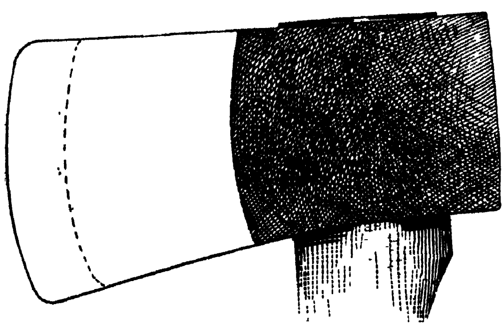


Fig. 24.

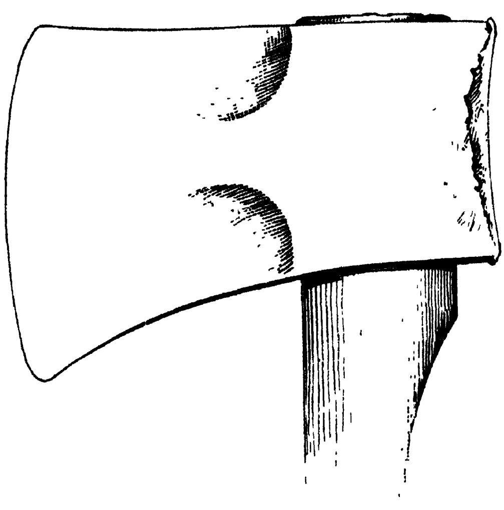


Fig. 25.

hardwood, Fig. 25. The other shape of axe, Fig. 26, is also a bad one to use, as the space between the handle and the edge (which is the point of impact, or in plain English "where it hits") is too great, and much of the force of the swing is lost. Another fault of these mortising-axe-shaped tools is that in soft timber they bite too deep, therefore not blocking the chip out freely, and they jar in hardwood.

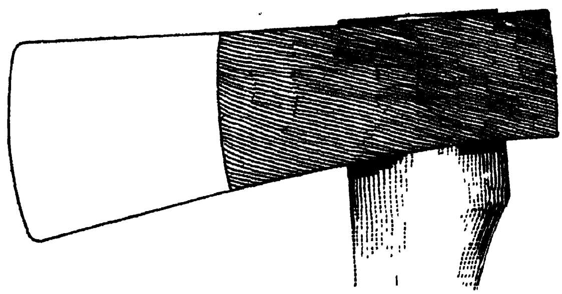


Fig. 26.

3. Why should the poll be smooth? For this reason; if burred, Fig. 25, it will cause the axe to jump or "chatter" when chopping the stump cut, and instead of your stump looking as level as a table-top, it will look as if a dingo had gnawed the tree down. More important it will take twice the strengh to fall the tree it should, because the burred edge clutches the stump top as it travels over it. Why should the weight of the poll matter? Because if the poll is lighter than the blade, the axe will not balance evenly in the user's hand, but will swing downwards, making the cut slant downwards as the result. In a district like this, where it is all firewood-getting, this is no matter, as the favourite cut is down-hill, (easier and gives a couple of feet more wood), but for chopping drives in scrub, or falling logs for the mill, the axeman must be able to cut his scarf to within a quarter of an inch, or he has no control over the tree. If the poll is *heavier* than the blade, it will keep the edge turned up-hill, and spoil the cut again. To judge a new axe's balance, grasp it and stand as if about to swing. Now open the hands flat, Fig. 27, and let the axe lie loosely on them. If blade and poll are properly balanced, the axe will lie perfectly flat. If either has the advantage it will dip that way. If a first-class axe is badly balanced, get your blacksmith to cut off enough to balance if he can temper. If not, put up with the evil, as he will spoil your axe's temper, perhaps spoil the steel altogether.

Fig. 27.

4. If it is not, both must suffer. It is again a matter of hard sense. A little man is lost with a heavy axe, unless perhaps he is chopping bundle-wood, when his work is all below him in the lying log, and the weight of the big axe is useful for wrenching out his billets. For chopping for logs and scrub from a pole or spring-board, a big axe is impossible, as its weight will pull the user off his perch to the ground, 10 or 15 feet below, if he makes a mishit; besides, a man must have arms of steel and whalebone to reach across the face of a big tree with a heavy axe, and keep his cut straight. From 3½ to 4 lb. is the proper weight of a falling axe; not an ounce over four, unless the user is a very powerful man, when he may go another half-pound. For chopping small lying timber and for fencing, a wide-bladed 6 lb axe is the best, though the handle must be shortened 6 inches, thereby losing the swing. You can chop the shoulders of the rails square better with it, and bump them up tight better too. For hammering wedges do not use any axe (see Fig. 25), get a maul.

5. By a suitable handle is meant—(1) one that has the grain the right way; (2) one that is the right shape and thickness. For the first, we saw in the description of wood what this should be, and why so.

This feature of the right grain, Fig. 28, Fig. 29, is very important in an axe-handle for two reasons: Firstly, that if you break it, as you generally do, at work, you may have to go ten miles for a fresh one, and when got lose a lot of time taking the remains out and putting the new handle in. New chums generally keep a spare handle with them, this is very nice for the other choppers with faulty handles, it saves them a lot of trouble when they happen to break theirs. If they do not, still the spare handle *will* roam into the scrub and get lost—anyway the deluded owner will not see it again. Another thing about a bad-grained handle is, that when chopping a big tree, you find out it is hollow by the simple process of your axe-head flying through the middle of the cut, and your handle only hitting the solid wood at the edge of the pipe. When this occurs, the bad handle parts across the middle, and the other half and the axe-head fall down inside. You can then exercise your mind as to whether it will pay you to chop it out at the bottom or buy a new axe.

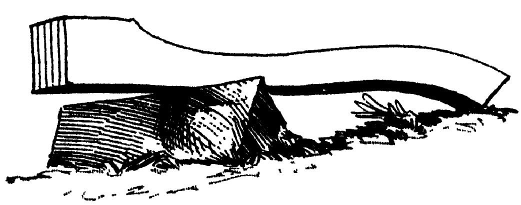


Fig. 28.—The right grain.

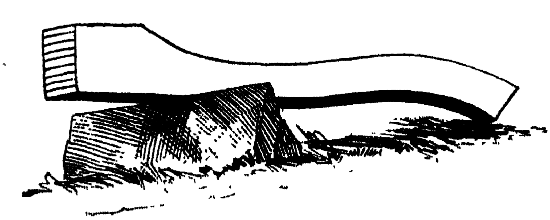


Fig. 29.—The wrong grain.

Now for the right shape and thickness. This varies with the size of the user's hand, and length of arm-swing. The main essential is that it shall run freely through his right hand when using. For a

left-handed chop, it will of course be the left. To gain this free-running, it should be spokeshaved down to that size, with no sharp edges to chafe the fingers. Some choppers like it quite round in the small part of the handle, others a little flat. It is a matter of taste, like stolen fruit. Be careful to chop the sharp point off the butt of the handle before using Fig. 30, or you will most likely imitate the Japs and commit happy despatch by jobbing it into your paunch or groin. Of course if you are in a lodge, this does not matter, as, if you die your heirs will get the benefit, and if you do not, you can hobble round on a stick and your lodge money, and advise other choppers to do likewise.

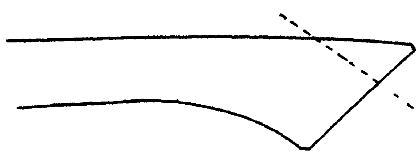


Fig. 30.

It is a curious thing that a good axe in the shop nearly always has a bad-grained handle in it. The only way to do then is to use the bad handle till it breaks and then put in a good one. You can, of course, take the handle out and give it away, if extra particular. To do this, take a brace and small centre-bit—one that just clears the wedge in the axe-eye ; chop the axe firmly down into a dry stump, and bore out the wedge clean, then work the handle about a little and it will come out. In buying a handle choose the right grain, and one thin rather than thick, all one colour, and that white or whitish-yellow. If offered one with dark and light colours in it by the storekeeper, throw it at him, as the colours will separate when worked, taking the different parts of the handle with them. I have bought a brand on the northern rivers which is called "the ideal thin grip." This brand is the best on the market, being true-grained, thin, and very springy.

(*To be continued.*)

INFORMATION CONCERNING CROWN LANDS LAWS AND AREAS AVAILABLE FOR SETTLEMENT.

A PAMPHLET has been issued by the Lands Department giving a synopsis of the land laws, together with full particulars of the characteristics and resources of the Eastern and Central Divisions of the State. Intending settlers will find in the pamphlet information as to the products, soils, timbers, means of communication, and other desirable particulars with respect to the various districts described. A useful map showing the average annual rainfall throughout the State accompanies the publication, which is obtainable at the Information Bureau, Department of Lands, Sydney, and all Crown Lands Offices.

In another part of this issue there will be found a list of areas available at present for settlement.

Forestry.

Some Practical Notes on Forestry suitable for New South Wales.

By J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney

VI.

What is Landscape-planting?

It is an application of good taste and common-sense to planting. There is no golden road to success in this work any more than in regard to many other occupations in life.

The artistic sense is the great guide for planting for decorative effect, and if one has no taste then common-sense will suggest that the work be delegated to those who have. Of course, knowledge of the plants handled is assumed. A man must know the sizes his plants attain when mature, or are likely to attain, under the conditions to which they are about to be subjected. How often have we seen plantations spoilt with a big tree overpowering small ones—not only injuring them, but destroying the effect that is often desired with large trees for a background, small trees or large shrubs next, and small shrubs in front. Then attention must be given to the natural requirements of the plants. Some like swampy ground, others are shade-loving, and so on. One must not, however, too slavishly follow past experience or what is believed to be sound precedent. Most planters are able to point to plants flourishing under circumstances which flout all precedent. It must be borne in mind that we cannot always judge the soil and subterranean conditions from viewing its surface.

Planting Trees—distances apart.

This obviously depends upon the size of the mature tree and whether it be in an avenue or open ground, or whether it is designed for timber. In gauging the size of a tree, it must be borne in mind that we have many climates and many kinds of soils, and the same species of tree varies much in size in various parts of the State. If that has not been ascertained in the particular locality in which it is desired to plant a special kind of tree, then there is room for the exercise of individual judgment.

I must, therefore, be excused from offering anything like definite figures for planting certain trees apart. The question can only be answered if a definite tree and a definite locality be quoted. The golden rule is, however, to allow the tree plenty of room if it be desired to see it live its life as far as possible unhampered and become an object of beauty. A tree can only be beautiful if left alone as far as possible. In botanic gardens trees are planted too closely owing to

exigencies of space, and then they have to be cut back, their lower limbs removed, and so forth. But interference by man in that way of the natural development of the tree is usually offensive to the artistic eye. In planting for forestry purposes, the trees should be much closer together in order that lateral branches may be eliminated and the knots in the timber thus reduced.

The Uses of Trees.

Apart from the æsthetic aspects of tree-planting, there are other advantages of a directly utilitarian character. Firstly, trees are valuable for their timber, fruits, or other products. Then we have the comfort of them, viz., shade in summer and moderation of the breezes in winter and other times of the year. The educational value of tree-planting should ever be borne in mind. In this connection we should pay attention to the names. I would have one specimen of every kind of tree and shrub in the school playground or park, labelled with the botanical and common name and native country. The teacher or trustee can obtain the names if he chooses to ask for them, and the labels can be so arranged that they are neither obtrusive nor an interference with the games of the children.

Arbor Day.

Arbor Day is fairly well kept in New South Wales. The same day is not observed in all districts ; it would be undesirable to attempt to do so, but it is hoped that a day in each year may always be more or less respected in every district. We rely upon the public school teachers of the State to keep alive the excellent idea of Arbor Day, and I speak from direct knowledge when I say that we owe very much to teachers for the public-spirited way in which they not only beautify the school grounds, but inculcate a love of planting in their pupils.

Speaking of Arbor Day in the United States, Professor L. H. Bailey says :—" Fortunately most of the trees do not live. They are badly planted and badly arranged." A standing joke in New South Wales is that the public school can be infallibly identified by two necessary small buildings. These at least should be " planted out." The matter of taste in planting cannot, I think, be taught except on very broad lines. I know a number of school grounds which display much taste in the planting, and I do not doubt that this work will improve year by year.

Let me say to teachers, " Do not plant in the wind." Choose your time for planting, and if Arbor Day turns out to be unsuitable in a particular district, be content with the ceremonial planting of one or two trees, leaving the bulk of the planting to be done on the best day available. The young trees have quite enough difficulties to encounter without handicapping them with an unsuitable planting-day.

Season for Planting Out.

In New South Wales most of the planting is done during the months of June, July, and August. In some localities, and with some trees, planting may be successfully carried out, in some seasons as late as

October, and even later. In some localities it is desirable, if convenient, to plant out in autumn, so that the trees may become established by the winter, and ready to put forth new growth early in spring. This applies with especial force to coniferous trees.

Deciduous trees raised in the Sydney district do not, however, lose their leaves until about July, as a rule, and it is always risky to plant them out until the fall of the leaf.

The distribution of plants from the public nurseries can, on the ground of expense, only take place during the winter when the great majority of plants are at rest; it is a matter for regret that the rule cannot be relaxed for some autumnal plantings, but this would add to the expense, which is already sufficiently great.

State Distribution of Plants for Public Purposes.

It is a matter of State policy that trees and shrubs, raised at the State nurseries, are supplied during the winter months to public bodies for improving their grounds.

Only trees and shrubs such as are usually propagated in large quantities, and which are hardy in most parts of the State, are issued for public purposes. No lists are issued.

Every care is exercised to send a selection of plants suitable to the district, but such plants as palms, camellias, roses, bouvardias, bulbous and herbaceous plants generally, and seeds cannot be issued.

The officers charged with the distribution of the plants endeavour to inflict as little hardship on nurserymen as possible, but the policy of the Government is based on the knowledge that in most cases unless the State gave some assistance, trees, &c., would not be planted at all.

The following are supplied from the Botanic Gardens:—

Court-houses, gaols, police lock-ups.
Railway stations.
Public schools.
Churches and convents.

Forest Department.

Municipal councils (streets, parks, &c.).
Progress associations.
Parks and recreation reserves (under trusts).
Pastoral and agricultural associations.
Hospitals.
Cemeteries.

Applications should give information as to soil and climate and area of land to be planted. Applications should be received in May if possible, as distribution begins on 1st June. The distribution ends with the month of August. Plants are not sold, nor are they distributed for planting on private property under any circumstances whatever.

VII.

Conservation, not planting, mainly required in New South Wales.

THIS country requires *conservation* of forests rather than formation of new plantations. It should be ascertained in what forest reserves young trees can be economically conserved, and reserves open to the timber-getter should be carefully cut over and then closed, if necessary, for a term of years. In European countries conservation, as opposed to planting, is more actively carried on than is usually supposed.

The initial cost of careful planting of young trees can only be justified in exceptional circumstances. Some well-meaning friends would urge us to establish plantations of soft-woods, *e.g.*, the Pines of the Baltic and North America, the Redwood of California, &c., but our climatic conditions are so different to those of their native countries that we cannot hope to compete commercially in the production of such timbers. Ours is a country which naturally produces hardwood, and it seems to me that we should promote the growth of the best of these, and rely upon the competition of trade to supply us with soft woods in exchange. Of course, if expenditure of money be no object, we can establish plantations of soft woods, but to secure this we may require to utilise land adapted to agricultural purposes and to expend funds on nursing plants for which the commercial returns will be altogether inadequate. In a country such as ours in which the functions of government are so extensive, it is sometimes desirable to ask oneself the question: "Would I incur this expenditure on private account?" I am referring now to the question of the cultivation of soft-woods. But I would certainly make experimental plantations of Silky Oak (*Grevillea robusta*) in some of the drier districts, which experience has already shown suitable to it, and the Red Cedar (*Cedrela australis*) should be judiciously re-planted in country from which it has been well nigh exterminated.

We are often told that planting is the principal occupation of a forester, and India is often quoted as the country whose example we should follow in forestry matters. I proceed to quote a passage from a paper by a personal friend, Mr. J. S. Gamble, one of the most distinguished of Indian foresters:—

> It is often supposed that the work of a forester is very intimately connected with the formation of plantations; but, as a matter of fact, although some planting work is done almost everywhere in India on a small scale to fill blanks, the formation of regular plantations has been very rightly considered as unnecessary, or at any rate, to be postponed, in view of the all-important work of securing and organising the actually existing natural forests. Still some good work has been done, witness the valuable plantation at Changa Manga, in the Punjab, on irrigated land in a very dry climate; the various teak plantations in Burma; the important plantations, mostly made with the object of restoring blanks, of deodar and pine, in the north-west Himalaya; the valuable india-rubber plantations in Assam; the plantation of Australian trees on the Nilgiris; and those of *Casuarina* on the shifting sands of the coasts of South India.—(*Journal of the Royal Colonial Institute*, Session 1902-1903, p. 184.)

South Africa and South Australia are also quoted to us as examples to follow. But these countries are comparatively treeless, and the policy of the excellent conservators of both States (whose friendship and counsel I have enjoyed for many years) is to raise plantations.

Conservation with them is a subordinate policy, as they have comparatively small areas of old forests to conserve. In New South Wales the the policy should be reversed; I would place conservation in the forefront, while planting should take a subordinate place.

* * * * * * *

What is a Working Plan?

The working-plan is as indispensable to a forester as a set of books to a merchant. I quote three authorities on the subject; only premising that some of the references will become clearer when I deal with the subject of sylviculture :—

A working plan is nothing more than a proposed scheme of operations; but the term is generally used to signify that there is some system in the scheme. . . . . . A working plan is conveniently opened with a brief descriptive account of the forests, their area, geographical position, distance from markets, with means of transport, measure of local demand, &c., with a comparison of current market rates, with ascertained rates of felling, logging, and transport.

Then taking up the blocks or subdivisions one by one, they should be classed as the first, second, or third period, &c., according to the predominating age of the trees; then should follow particulars as to their general condition, estimated amount of standing stock, and the mode adopted in determining it, stating whether the forest is fully stocked, the condition of the forest floor, whether covered with grass or rank undergrowth, &c.; and this should be supported by a map, which is conveniently coloured with different shades of green, to enable the age of the prevailing trees of each block to be distinguished at a glance, and with some other colour or colours to denote the intermixture of other than the prevailing class of timber And at the close, the information as to the total area, area bare, area barren or unfit for forest, area stocked, with estimate of standing stock in each period of growth, may be conveniently presented afresh in tabular form.

Next might follow proposals for the method which is deemed best suited to the ascertained conditions, the order in which the several blocks are to be taken in hand, if rotation of area is determined on, estimate of stock to be felled annually, with a general budget estimate of financial results, which should be the basis of future annual budget estimates. Then should follow proposals for reproduction, with the experience or data on which the method has been accepted as reliable.—(Amery: "Notes on Forestry," p. 112.)

Then we have some observations from Gamble :—

In its simplest form, therefore, a "working plan" is a scheme which decides what interest (that is, what amount of material) can be yearly obtained without decreasing the capital, and rather with the future hope of increasing it, and with the increase of the capital obtaining an increasing interest. . . . In some cases, the preparation of a working plan is a very simple operation. Take, for instance, the case of an area of, say, 6,000 acres of fairly good forest, not containing export timber, but merely the ordinary woods of the region, and expected to supply the wants in small building material and fuel of a number of adjacent villages, with perhaps a small amount of better-class building wood. Inquiry shows, perhaps, that the simple system of coppice-wood gives the best return of the material most wanted, and that such material reaches its best size in thirty years; it will obviously be possible to cut $\frac{6000}{30}$, 200 acres yearly, arranging the localities of cutting so as to suit the centres of consumption. This is a very simple plan, and indeed it is the one which has been very largely adopted in those regions where purely local demands have to be met.—(*Journ. Roy. Col. Inst.*, 1902–3, p. 179.)

Then, again :—

A forest working plan has for its object to lay down the entire management of a forest, so that the objects for which the forest is maintained may be as fully as possible realised. In order to be of any use, it must be based upon an exact and detailed examination of the actual state of the forest in all its component parts; next, the forest must be divided

into divisions of workable size; the leading principles of management must be indicated, and the yield calculated.

The whole material is then brought together in a working plan report. Finally, arrangement must be made to control the execution of the plans and to collect additional information, so that every succeeding working plan may be more accurate and the management may become more and more exact.—(Schlich, III, 257.)

The following illustrated "Working Plan Report" is copied from Schlich:—

CHAPTER I.—GENERAL DESCRIPTION.

1. Name and situation of forest; name of proprietor.
2. Boundaries.
3. Area.
4. Configuration of the ground.
5. Rock and general character of the soil.
6. Climate.
7. Legal position of forest; rights and privileges.
8. Surrounding population and its requirements.
9. Markets; lines of export.
10. Prices of the several classes of produce.
11. Cost of extraction and of transport; supply of labour.
12. General description of forest growth.
13. Injuries to which crop is exposed.
14. Rates of growth.
15. Yield tables, volumes tables, form factor, reducing co-efficients, &c., used in the calculation of the volume and increment of the woods.
16. Organisation and strength of the forest staff.

CHAPTER II.—DETAILED DESCRIPTION OF COMPARTMENTS

CHAPTER III —DIVISION AND ALLOTMENT OF AREAS.

CHAPTER IV.—DESCRIPTION OF THE METHOD OF TREATMENT.

1. The objects of management.
2. Choice of species.
3. Choice of sylvicultural system.
4. Determination of the rotation.
5. General lines of treatment.
6. General lines of yield.

CHAPTER V.—GENERAL WORKING PLANS.

1. Plans of utilisation.
   a. Final cuttings.
   b. Intermediate cuttings.
   c. Minor produce.
2. Plan of formation.
3. Plan of other works.
4. Maps illustrating the condition of the forest and the proposed treatment.

My whole training and experience teaches me to admire and appreciate thoroughness of work, but I would submit that anything approaching these details is unsuited to the conditions of New South Wales. We must, indeed, work on broader, simpler lines.

Schlich proceeds to give as illustrations the working plan for the forest of Krumbach, in Germany, for the period 1888–1907, also one for a portion of the State forests of the Herrenwies Range in the Black Forest.

The details given are full of interest, and I should revel in forming a working plan with as much thoroughness and as far as possible on the same lines for one of our State forest areas. But our circumstances are very different to those of Germany. Our forest areas are larger, population is very much sparser, the demand for timber is comparatively

small, and timber is cheaper. Nothing is wasted in Europe. Small thinnings are utilised that would surprise an Australian, and small trees are conveyed long distances and sold for high prices. Then, let me add, the benevolent despotism, which obtains in India and Germany, which is excellent for forest management, is out of the question in this democratic country.

The working plan, therefore, consists of the complete data concerning a particular forest and the administrative ideas of a forester. The expression is often used as if the working plan were confined to Europe and India. I have been urging the preparation of working plans for our forests for years. No man can form a working plan of a forest with which he is not well acquainted, and the primary difficulty that presents itself to every non-Australian is the special one of recognising the various kinds of eucalypts, so similar and yet so different. I doubt if there is a country in the world whose trees are so difficult of recognition by the forester as are those of Australia. What are known also as the brush trees are also frequently difficult of discrimination.

The working plan of a forest is therefore dependent upon a botanical survey of the same, and that being so I will again lodge a plea for a botanical survey. Its desirability is so obvious that I require only to touch upon a few points which suggest themselves, because of our special circumstances and environments. The establishment of a botanical survey need not involve the expenditure of a large sum of money, but rather the organisation and control of existing agencies which may subserve the grand object in view. I feel sure that in country districts there are hundreds, nay, even thousands of private citizens and officials, such as engineers, surveyors, mining, land, and forest officers, school teachers, postmasters, and many others, who would give voluntary aid to the furtherance of a botanical survey. Many would, in their spare moments, gladly supply information and collect specimens if they knew what would be acceptable. But while the work must be largely voluntary, it need be none the less systematic. I have conducted an informal botanical survey on my own account for many years, but my correspondents, although many, do not represent the whole of the State, and their work has been necessarily of a fitful and unorganised character.

In time to come we shall not only have geological and mining surveyors, but also agricultural and forestry surveyors. I use the word surveyor (as regards agriculture, forestry, &c.), not so much in the sense it bears as applied to a land-surveyor; for a man may be able to furnish valuable information suitable for a botanical and agricultural survey, and yet be incapable of using a theodolite. To summarise, I would use the term "botanical survey" as correlative to geological survey, and besides forestry it would include observations applicable to:—Pure botany, agriculture, and horticulture.

One of the matters to which attention would be given by a botanical survey would be that of ascertaining the heights and trunk-diameters of various kinds of trees, different observations being made in regard to the same species in different districts. In this way a ready index would be obtained as to the climate and soils in which various species

flourish best. Notes would also be taken of the sizes of abnormally large trees. These are, of course, becoming rapidly fewer ever since the advent of the white man. If the identity of individual trees be noted, either by marks on or near trees themselves in the forest, or on the maps, it would be easy to prepare records of the rates of growth of our Australian trees, a matter of considerable economic importance and of some scientific interest, but in regard to which we possess very few data at present. In a system of scientific forestry these data are simply indispensable.

First of all let us take stock of our forest reserves. Let them be accurately defined; and let those areas be rejected that are not required. It should be recognised that our country contains a large proportion of land unsuited to agricultural purposes; much of this is available for forestry operations. It therefore seems equitable that the land suitable for crops and good pasture should, if held at all by a forest department, be held only until required for purposes of settlement.

I would protect the forests at the heads of water-courses and in broken country generally. Much country of that character is of no use for agriculture, and its dedication for forestry purposes would not excite the cupidity of persons in search of land.

It has been decided to classify our forests, but no method will be satisfactory that is not based on the ecological principles to be alluded to later on. We have not, however, full data at present to make a final classification of our forests. These will be secured as our botanical survey is pushed on.

I understand that the classification of the timber-bearing lands, so as to define their relative values for growth of timber and for agricultural purposes, has been proceeding, under the auspices of the Forestry Department, for some years, and is to a large extent completed.

Then I would enunciate the axiom that we require to take stock of the trees upon the national property. What kinds have we? Where are they? Where do they flourish best? What is their state of maturity? For what purposes are the trees best suited? Can we answer all these questions? I fear not, and until we can do so much better than at present, I am afraid that our dealings with our forests will be based on empiricism. We ought to be in a position to inform an interested inquirer, at short notice, in what part of the country there is to be found timber best adapted for a certain purpose, and in what approximate quantity. Until we get this survey, which need not be minute, of our resources, I am afraid we shall not have a Forest Department which will command the full confidence of the country.

This botanical survey of which I have spoken, will lead, by the quickest road to an accurate knowledge of the properties of our timbers. There is no stimulus to inquiry more keen than that of pecuniary interest, and the commercial man will ascertain the value of timber for his own purpose if he be given an opportunity. For all commercial purposes there must be—(1) a sufficiency of the article;

(2) continuity of supply. How can a man be assured of this except by a botanical survey? He uses a piece of timber and says:—"This will do admirably for a certain purpose," or "If I had a large supply of this timber I could utilise it at once." These statements have been made to me hundreds of times by Australians, and by visitors anxious to do business with us, but they have often been stopped at the threshold by my inability to answer the pertinent questions to which I have referred. I therefore would put the botanical survey (or whatever name one may choose to call it) amongst the very first of the duties to be undertaken by a Forest Department. Examination of our timbers can go steadily on even before a survey is made, but such examination must be fitful and incomplete until it receives the stimulus of the attention of users of timber and other commercial men actuated by self-interest. It is not for me who have, perhaps, been longer engaged in critical investigations concerning the identification, properties, and uses of our timbers than any other public servant in New South Wales, to depreciate scientific research, but I have experience of the many limitations of the scientific and technological investigator.

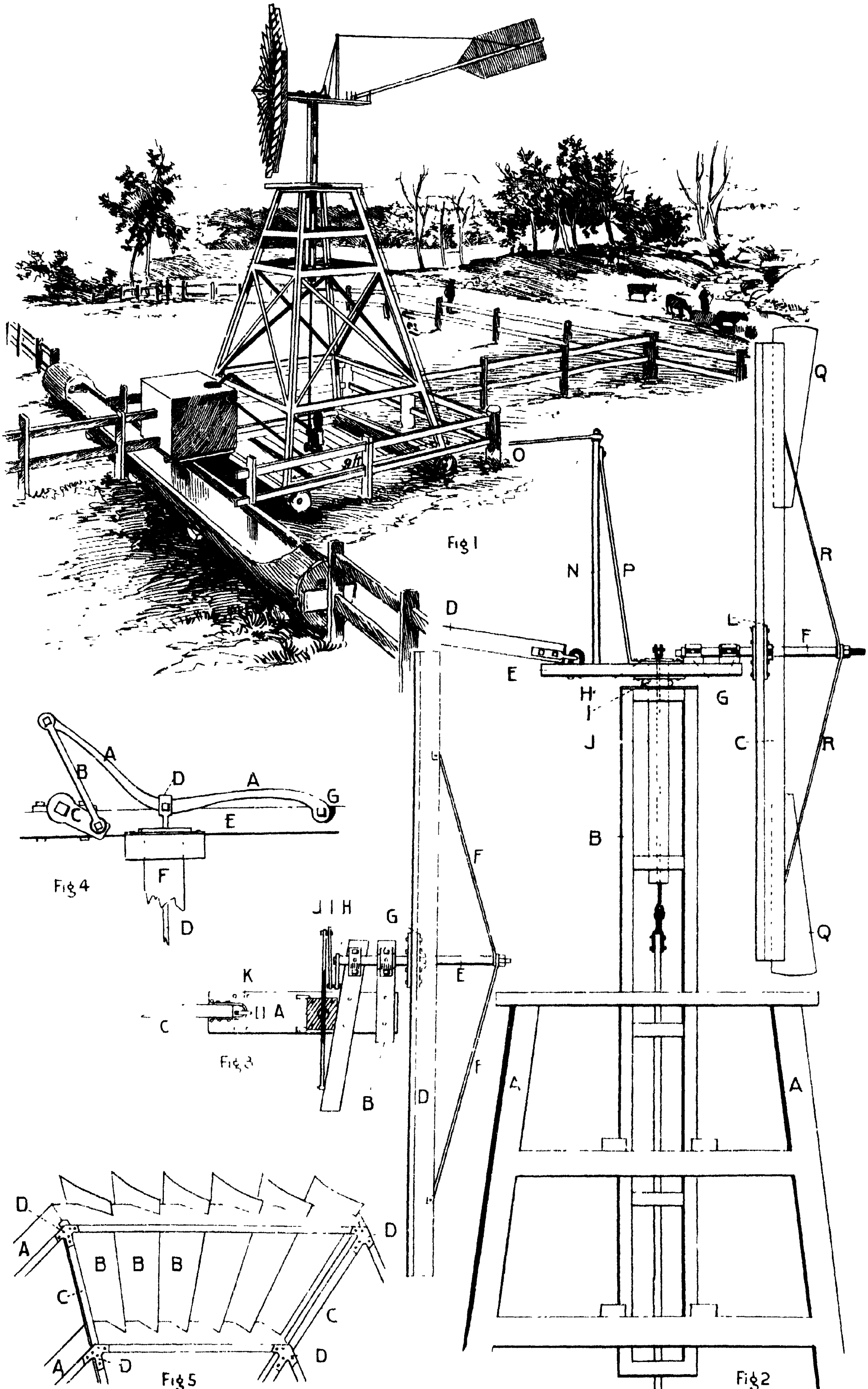
(*To be continued.*)

The Yellow-jacket, or "Napunyah," as Food for Sheep.

Mr. William Christie, c/o Messrs. Pitt, Son, & Badgery, sends some twigs from the Maranoa district, Western Queensland. Mr. W. H. Clarke writes:—"The leaves and blossoms are reported to be not only a good sheep food in themselves, but good also to use with more astringent scrub. Mr. Christie has fed thousands of sheep, and is now feeding a great many, on this 'napunyah' foliage. In view of the possibility of sheep-owners in some districts having again to feed their sheep in scrub, many pastoralists would be interested in a report as to the identity of 'napunyah.'"

This tree is known to botanists as *Eucalyptus ochrophloia*, F.v.M., and it is found on the Paroo River, New South Wales, and other places in far western New South Wales and Queensland.

Eucalyptus leaves must always be looked upon as famine food; at the same time, western sheep have often to put up with fare that their more favoured relations in the central and eastern divisions would turn up their noses at. Reference to eucalyptus leaves for fodder will be found in the Gazette for June, 1899, p. 496, and for August, 1903, p. 765.—J. H. Maiden.



A HOME-MADE WINDMILL

1. Two methods of Watering Stock. 2 Elevation of Windmill 3. Plan of Working Parts 4. Crank 5 Fans
For details, see references to letters in article

A Home-made Windmill for the Farm.

GEORGE MARKS.
Experimentalist, Hawkesbury Agricultural College.

THE origin of the windmill is unknown. Early writers record its use in Europe as far back as the twelfth century. The windmill as then used consisted of arms carrying the sails and mounted upon a revolving post, and in order to keep the sails to the wind a lever was attached to this post and worked by hand. It was found necessary on this account to watch it continually, especially during periods of changing windy weather. To obviate this inconvenience, a "tail" was fastened behind the fans in such a way that the force of the wind kept the sails in the desired direction.

At the commencement of the nineteenth century the windmill was almost exclusively used for pumping purposes, grinding grain, sawing, &c., and, although it has been superseded largely of late years by steam and other engines, still it is found to be used extensively in most of the European countries and in America as a means of supplying cheap power on the farm, particularly in those districts where fuel is scarce and work may be done intermittently. Economy in working forms a special feature in the utilisation of wind power, and in suitable positions, with favourable conditions, a windmill may be expected to average about 8 hours' work in the 24.

In this State, with our prevailing winds, particularly along the coast, the windmill can be used with advantage. For the dairyman or stockbreeder who has to depend upon wells or pumps for his water supply it would be especially useful. The schoolboy on the dairy farm knows what it is to pump water for 40 or 50 cows morning and evening. The purpose of this article is to show how with proper arrangements the windmill may be made to do practically the whole of this work.

There are various styles and makes upon the market, differing from one another chiefly in their construction and to a greater or less extent in efficiency. The farmer who is close to town and in comfortable circumstances is able to obtain any of these to suit his fancy, but the selector or pioneer is not so situated. In most cases he is not over-burdened with capital, the holding is generally a considerable distance from a town, railway, or port, the roads are rough, and the cost of obtaining and conveying a windmill to the homestead is considerable. Any man of ordinary intelligence, having limited capital, but handy with tools, should be able to construct a useful and serviceable windmill, and apply its power on the farm, and thus effect a great saving in time and labour.

First of all a site has to be selected. This will depend to a large extent upon the use to which the windmill is to be put. For pumping purposes it would require to be near the spot it was intended to

have the pump. In order to obtain the greatest amount of power from every prevailing wind, the highest and most exposed spot should be chosen. If it is intended to drive machinery in a barn the framework should be built sufficiently high to carry the fans clear of the buildings. In this case the frame would require to be made larger in proportion to the height.

Almost every selector has abundance of timber, and no better foundation can be obtained than by securing two sound hardwood logs and letting them in the ground to half or their full thickness. If it be on a slope, the top side should be well let in so as to keep them level. For a frame 12 feet high the logs may be placed 9 feet apart. It is better to have them fairly long, as it would make the foundation more substantial and would also serve as a support for water-troughs, etc. This is very important because during strong winds or gales there would be a severe strain upon the structure, which, if not secured to a firm foundation, might topple over. These logs are kept in place by placing lighter logs crossways, 9 feet apart, letting them in to one another, and securing them by bolts or wooden pins. Upon this foundation the framework may be built of sound timber, roughly squared to take the sap wood off. The bottom should be bolted to the cross-pieces and strengthened by stays. The outside posts are secured at the top by bolting them to stout pieces of timber, bringing them in to about 3 feet apart each way. Cross-pieces are also bolted to the frame at 2 and 4 feet from the top. From the centres of these, other cross-pieces are bolted. The upright frame which supports the sails and tail, and through which the connecting-rod works, is secured to these, and held in position by bolts.

Support of the Sails.

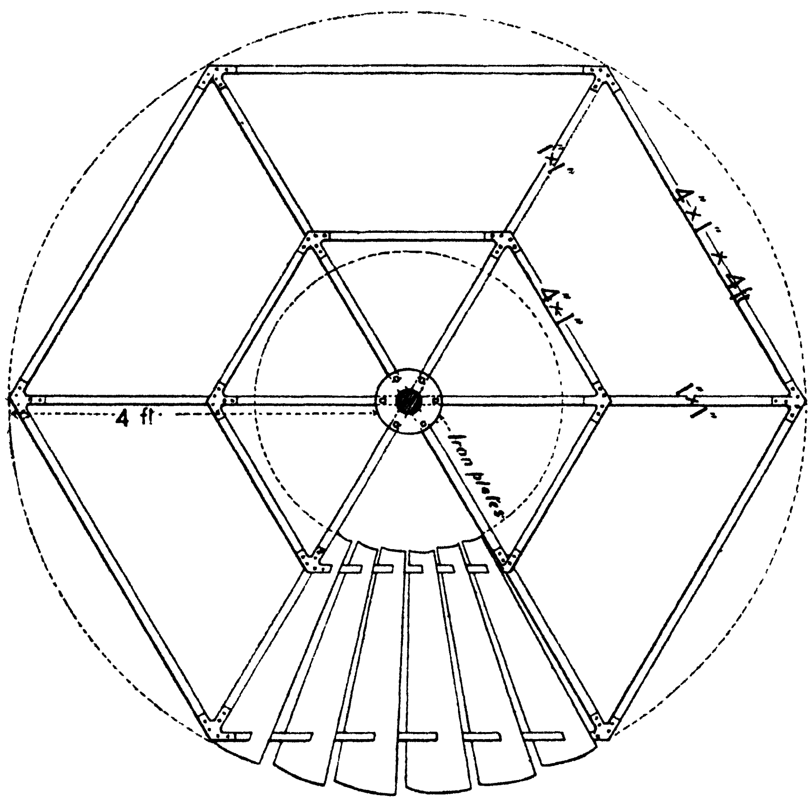
A few sound straight slabs will be found useful for this part of the structure. The pieces should be about 10 feet long and trimmed with the adze to about 2 inches thick by 8in. wide. Two pieces are required. Four other pieces, 8in. x 8in. x 2in. are next bored so that an iron rod or wooden connection may pass freely from the crank above to the plunger of the pump beneath. Two of the pieces have holes large enough to admit of an iron pipe. These four pieces are placed between the two long pieces and securely fastened together.

The platform to carry the sails should be about 8 in. wide, 2 in. thick, and 4 feet long. In order that the sails may be free to move in any direction as the wind changes, this platform should be so arranged as to admit of this movement. It will be necessary to obtain a piece of large-sized piping, about 2 feet long, three iron plates having holes cut to admit of the pipe passing through, and an iron ring large enough to fit over the pipe. A hole for the pipe to pass through is bored through the upper plank, a plate is bolted on top and bottom, and another plate on the top of the support. The pipe is inserted through the top, and the top edge is burred to prevent it from falling through. The iron ring is placed between the support and platform, and if this is kept well greased will be found to move with ease. The

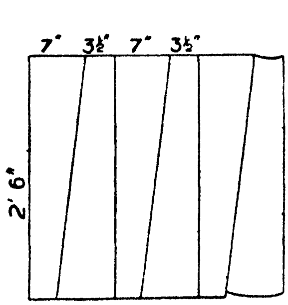
sails and platform revolve on this ring, and the pipe, whilst allowing of the passage of the connecting rod to work the pump, keeps the top in position.

Sails.

Six pieces of strong timber 1 in. x 1 in., 4 feet long, are fastened to an iron axle by six bolts and two iron plates. Upon these are fastened pieces of timber 4 in. x 1 in., six on the outside and six on



the inner side, 2 feet from the end of each arm. Upon these are fixed the fans, which are best constructed of pieces of galvanized iron 2 ft. 6 in. long, $3\frac{1}{2}$ inches wide at one end and 7 inches at the other. Thirty-six of these will be required. A piece of iron 2 ft. 6 in. wide should be obtained, and by cutting these as shown in the sketch there will be no loss. To fasten these in frame, make a narrow saw-cut about 2 inches deep, at an angle in the outside of the two rows of cross-arms, and let in the fans. These should be curved, and to keep them secure, and in position, they may be fastened with a nail and light wedge.



The axle extends about a foot in front of the fans, and iron rod

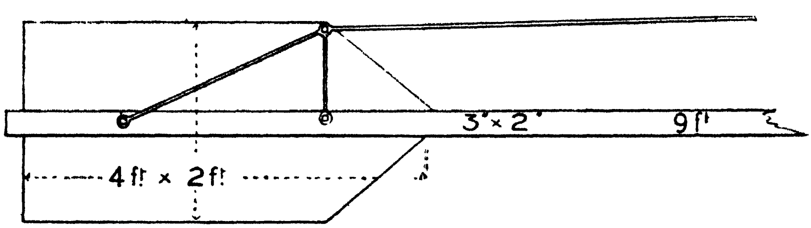
stays are fastened at one end to the arms (about a foot from the end), and at the other, to the end of the axle. These, though light, greatly strengthen the arms.

The other end of the axle is supported on two pieces of 3 x 2 timber, which are securely bolted to the platform. On the end is fastened an arm of iron 4 inches long, and marked C in Fig. 4 of the full-page illustration. At the free end of C is bolted another arm B, 8 or 9 inches long. A third arm A, 2 feet long, is bolted at one extremity to B and at the other to the 3 x 2 timber at G. The connecting rod is fastened about midway at D. These should all be so bolted as to allow of free movement.

Tail.

This should be sufficiently large and long enough to keep the sails to the wind. A piece of sheet iron 4 ft. x 2 ft. fastened to a piece of timber 3 in. x 2 in., 9 or 10 feet long, will be found large enough. This may be cut to any desired shape. The end is fastened to the platform with an iron staple, and is also supported by an iron stay stretched over an upright 3 feet high.

The tail is kept in position by having a wooden pin on each side of the long arm. If required to throw it out of gear, the tail may be pulled round upon removal of one pin, and held at right angles by another pin.



In arranging the tail and fans, care should be taken to keep the platform as far as possible evenly balanced on the iron pipe.

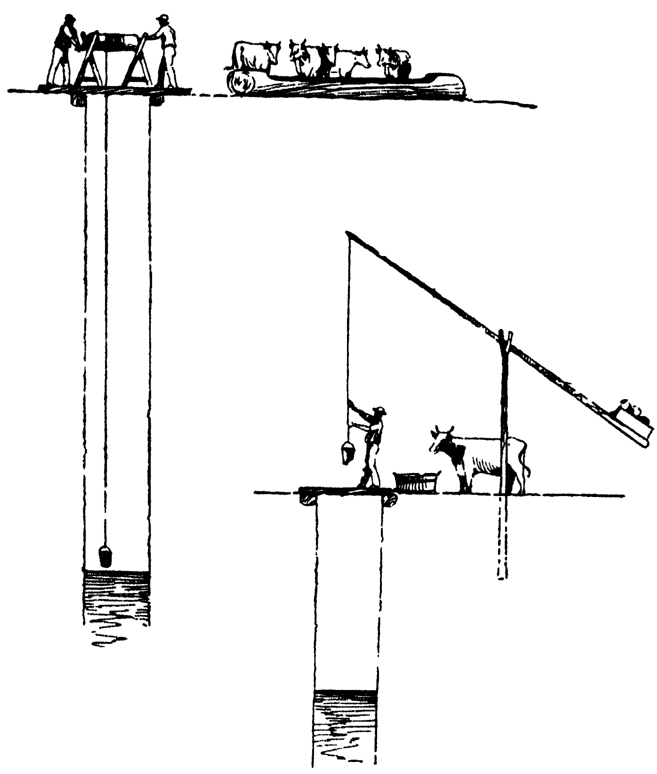
The connecting rod is fastened to the plunger of the pump underneath.

The foregoing is one form of home-made windmill, but there are many other ways of arranging the crank, &c., and also the sails.

In utilizing windmill power for driving machinery, it would be necessary to have the sails much larger and stronger in proportion. One having a diameter of 10 feet would develop about one-eighth horse power with a wind blowing 10 miles an hour, while one 22 feet in diameter would develop about one horse power. By means of a fly-wheel and shafting, the power can be transmitted to different parts of the barn as desired.

It will be found, however, that one of the best uses to which a windmill of this kind can be put is that of raising water for various purposes. Large numbers of farms in different parts of the State are without running rivers or creeks, and where the water has to be raised from tanks and dams this question becomes an important one. To raise this

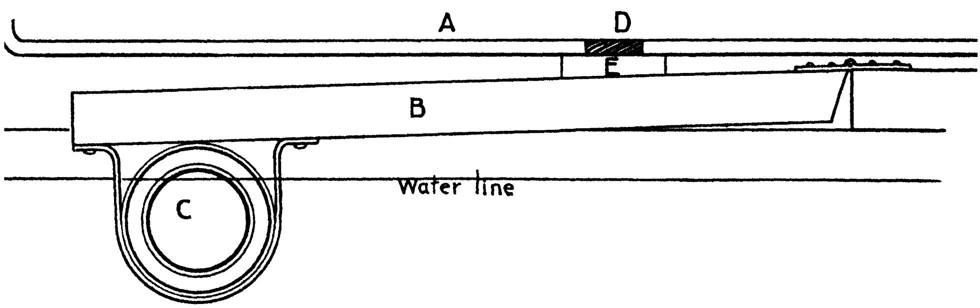
water by hand entails a great deal of labor and time, and many are the devices used to minimise this. At the present day the ordinary post with a long pole can still be seen in some parts of the State, whilst in others the windlass is extensively used. It will be readily seen that where water has to be raised in such small quantities a great deal of time is spent to water a large number of animals. Where water is stored in dams or blind creeks, the stock are often allowed to help themselves, and may be seen wading knee-deep. The consequence is, that not only is the water kept continuously muddy, but it is also polluted, and one can readily understand that such a state of things is not healthful. Where the supply is limited, it is most important that the source be not contaminated from any preventable cause.



This may be accomplished as follows—by fencing off the areas occupied by the water in the case of dams and tanks, and erecting a windmill and suitable troughing, thereby preventing stock from gaining free access to the water. Where a well or tank has to be sunk in order to get a supply, as is the case with some springs, the earth excavated can be utilised in raising the surface of the ground, thus preventing water from around the drinking troughs from running into the well in times of heavy or continuous rains. In places where the water is obtained from a great depth, a lift and force pump would be required, and placed near the surface of the water. This would need extra piping and an extension of the connecting rod. Where the

water is only a few feet from the surface, the pump may be set on the surface, or raised a little so that water would flow by gravitation to the trough.

With a little care in the arrangement of the windmill and troughing, the water may be kept at an almost constant level, and little attention is required beyond occasionally oiling and greasing the different parts. Fig. 1 in the full-page illustration contains a rough idea how this may be done, and shows a tank arranged over the drinking trough, which is kept full. The windmill may be allowed to work continuously, and an overflow pipe is attached near the top of the tank to convey the surplus water back to the well. This tank acts as a reservoir and holds a supply ready for flowing into the trough when required, and during times when there is no wind to drive the mill. By having an automatic tap the water may be allowed to run into the trough as fast as it is used. A home-made one may be made as follows: A piece of 1 inch board, 2 ft. 6 in. long, is bolted at one end to a part of



the trough, or preferably to a frame fitted in the trough, in such a way as to admit of the other end moving freely with an upward and downward motion. At 6 inches from the bolted end a flange is fitted, which, when the free end of B rises, covers and completely cuts off the water that passes through the opening in the tank at D. At C a float is arranged—a treacle tin having a patent top will do admirably. The idea is simple. When the float lowers, as it does when the water is used by stock, the flange at E allows the water to escape. The float rises with the water, and when full the supply is again cut off at D. Care should be taken that the flange fits accurately. It is also well to have this covered in, so that stock may not interfere with it.

For the trough nothing is more substantial than a good hollow log. This, when properly arranged, is firm, and not likely to be removed or overturned. By having a long trough and the tank arranged over the centre, a division fence may be run and the trough used for watering two paddocks, but as large a space as possible should be allowed so that vicious animals may not injure others by getting them in corners.

Where the supply is situated near the homestead, the water may be distributed over the various departments by having a number of tanks raised on proper stands, and conveying it by means of pipes laid underground. By this means not only is the arrangement very

convenient for the stables, dairy, piggery, poultry yards, &c., and even the house itself, but it will be found very effective for the flower and kitchen gardens. A week or so of dry weather is often quite sufficient to destroy a fine garden of vegetables or a choice collection of flowers, and in positions where water may be conveyed as above described, the advantages to be derived from such an arrangement cannot be overestimated.

Cost.

This windmill, made of sawn undressed timber, at 12s. per 100 feet, if erected by paid labour, with force pump and all ironwork, would cost about £15.

A handy man, utilising such spare time as he occasionally gets after wet weather, when he is unable to get on the land, and using the adze in trimming his own split timber, could erect such a structure in a very substantial way, and the only monetary expense would be in procuring the pump, pipes, and other ironwork. The local blacksmith should be able to supply all the ironwork required at a total cost of £6 or £7.

To fit up the tanks and lay water on to the homestead, the cost would, of course, be increased according to the number of tanks and length of piping required.

The application of a coat or two of coal tar will be found very beneficial, and by thus protecting the woodwork from the weather the life of the windmill will be considerably lengthened.

Hawkesbury District Farm Notes.—January.

H. W. POTTS.

The dry spell which lasted for nearly two months until just before Christmas has retarded the growth of spring-sown crops, and interfered with the sowing of the later crops for green feed. No opportunity can now be lost in stimulating the growth of what there is by frequent use of the scarifier to prevent weeds from robbing the crops, and to make the small amount of moisture go as far as possible in providing for the requirements of growing plants. If a good thunderstorm catch the farmer unprepared, with his soil caked on the surface, the chances are that the crops will derive no benefit, whereas if the heavy shower falls on soil that is in condition to absorb and retain every drop of moisture a few showers will go a long way towards ensuring a fair yield.

It is generally said by practical visitors to the College Farm that the soil is naturally of a character so light and so ill-suited for agricultural purposes that no man would attempt farming as a business venture upon it. It is possible that there are not many soils to be found in this State which do parch out so readily, but it is to be feared there are soils on some farms which, through lack of good management and a suitable system of rotation to maintain the supply of humus which is the principal factor in the retention of moisture, are being rendered every season less productive. Where leguminous crops,

such as cowpeas, peas, or vetches, are used in the rotation of crops at the Hawkesbury Agricultural College visitors are often astounded at the difference in the quality of the soil. The improvement is so great that the plan can be safely recommended for adoption on maize farms particularly, which through long cropping with the one class of plant have become depleted of available plant-food, and have run down so far that even heavy manuring will not produce satisfactory results. As a matter of fact, manures are more or less inoperative in soils devoid of humus. A good plan for the maize farmer to adopt would be to either put aside in rotation each year a portion of the maize area to be cropped with cowpeas to be used for green fodder or turned under as circumstances may render advisable, or to put the whole area under a leguminous crop, such as vetches or field peas, as soon as the grain is harvested. Such a crop could be utilised for pigs or dairy cows, and would be off the land by the time the next maize planting begins. Next in value as a soil improver would be the use of a rape crop, which can be put in at very small expense, not more than a couple of shillings per acre for seed, and used for forage or grazing. Cowpeas are sown in spring; all the others in autumn.

Sorghums are worthy of attention in seasons of inadequate rainfall, as they are generally resistant of drought and will thrive in soils that are too poor for the profitable production of maize crops. In growing sorghum especial care must be given to the cultivation of the young plants which are delicate until their root system is developed. At the Hawkesbury College Farm we have under trial all the old varieties of sorghum and some recently introduced kinds. The results from the latter in such a season as the present will be of interest.

Sorghum sown this month and well looked after should provide good supplies of forage for the early winter.

Millets can also be sown this month for winter green feed.

For the late crop of potatoes in this district (sown about the middle of January) and for sweet potatoes which can still be planted out with every prospect of successful results, the land should be got into readiness as soon as possible. If supplies of stable manure are available, it will be better to mulch the rows at this stage of the season than to incorporate the manure with the soil. Of course, if ample rainfall could be depended upon, the manures would act beneficially, but if conditions should remain unfavourable their effect in direct contact with the roots will be to retard rather than advance growth. Every effort should now be made to get any areas available ready for swedes and mangolds for fodder. The soil must be worked into fine and deep tilth, and when the crop is sown a little superphosphate put in with the seed will push the plants ahead.

Opportunity should also be taken now to get an area ready for lucerne to be sown in April. The great drawback to the successful establishment of a plot of lucerne is badly prepared land infested with weeds. The hot weather is a favourable time to destroy weeds by means of shallow ploughing and frequent use of the scarifier to tear them out to perish in the sun.

Orchard Notes.

W. J. ALLEN.

JANUARY, 1905.

In many districts the rainfall has been insufficient for the summer fruit-crops, but wherever the trees have received proper attention by keeping the soil well stirred and free from weeds, they have put on exceptionally heavy growth this season. In many cases this is due in part to the fact that the trees are carrying light crops of fruit. At time of writing we are badly in need of rain for the citrus trees; in fact a good soaking rain would do many of our orchards a lot of good, but might be harmful to the vines, inasmuch as it would be favourable for the development of black spot, and, already, the vignerons in some districts have had to fight this disease very hard this season to keep it down. At one of our Government vineyards we have already sprayed four or five times with Bordeaux mixture to check this disease, and our work has been very successful so far, as we have succeeded in keeping it down.

Those who are growing apples must attend to bandaging the trees, picking up and destroying all fallen and infested fruit, and, wherever possible, picking the infested fruit from the trees. A spraying with arsenite of soda would still be helpful, but if the growers expect to keep down the moth so as to enable them to pick 50 per cent. of clean fruit, they will all have to steadily fight this pest, if they hope to succeed.

Much ado has been made of the fact that, up to the present, the Department of Agriculture has discovered no cure for the Fruit Fly. In making capital out of this fact, writers forget to mention that if all fallen and infested fruits were picked up and boiled, we would in this way destroy so many of the larvae that it would only be a matter of time before this much talked of and destructive pest would be almost wholly eradicated, and, in consequence, the loss of fruit reduced to a minimum.

See that the citrus trees are not allowed to become dirty with either red or brown scales or white louse. Fumigate wherever the trees are at all bad, or in cases where only a few are found on a tree, these might be sprayed with the resin and soda wash.

Peaches fit for canning and drying will ripen this month. For the latter purpose, see that the fruit is thoroughly ripe before picking from the trees. Cut them evenly before placing on the trays cut side up, then submit them to sulphur fumes for about two hours, after which they may be placed either in the sun or evaporator, as the case may be. As soon as they are sufficiently dry, remove from the trays and place in calico bags, to keep them away from the fruit moth.

In canning, the fruit should be selected and peeled, then packed tightly in the bottle or tin, and a syrup varying in strength from 30 to 40 per cent. sugar should be poured over the fruit, filling to within a quarter of an inch of the top. If tins are used, they should be sealed down, leaving a pinhole in the tops. Exhaust by plunging into boiling water for five minutes, at a temperature of 212 degrees. Remove and solder up the small hole, then plunge into the bath again, and cook for fifteen minutes at a temperature of 212 degrees. A little longer cooking may be necessary if the fruit is hard, or less if it is soft.

If a retort is used, cook for five minutes, at a temperature of 240 degrees. Nectarines and pears do not require cooking so long by two or three minutes in the open bath, and only from three and a half to four and a half minutes in the retort, at a temperature of 240 degrees.

THE attention of orchardists is specially directed to the article which appears in this issue by the Fruit Expert on green manuring of orchards. The writer has seen the Bathurst orchard at every stage, from the time when the hillside upon which the plantation is located was timbered and used as a resort for large crowds of people at race meetings. When the soil was broken up the clods were so big and so rough, and the soil was so harsh that a new pair of boots would be pretty well ruined in a day's tramp on the site. When heavy rains fell the gritty soil melted down like sugar and flowed in rugged gullies down the slope. Then when the rain ceased the surface would set as firm as mortar. By the growth in winter of crops of tares or vetches to be ploughed under for green manure the character of this soil has been improved almost beyond recognition. The clods turned up by the plough crumble at the lightest touch of the foot, the implements that, after a heavy thunderstorm would either slither on the set surface or tear out rugged lumps as big as a child's body, now glide smoothly and easily through the mellowed mass. The rainwaters that rushed down the slope are caught by the soil and retained so well that in a season like this (the writer inspected the orchard on 12th and 13th December, 1904, and up to the last date the rainfall since 1st January was 16½ inches) the trees have not only made vigorous growth, but are carrying just twice the amount of crop that they did in 1903, which was, so far as rainfall was concerned, an exceptionally good year.

At the Hawkesbury Agricultural College, where the soil, with the exception of one patch, is practically pure sand that one could cook eggs in on any warm day, the summer fruit this season is as good as in any favourable season. This, as any orchardist who cares to take the trouble to go there may see for himself, is simply due to the fact that by the incorporation of crops of leguminous plants for green manure, every drop of water that falls on the soil is absorbed and retained for the use of the trees. It is safe to say, that 20 inches of rain falling on soil improved by the addition of humus or vegetable matter will produce equally good or better results than 40 inches falling on soil depleted of vegetable matter, and which in consequence, dries out and becomes parched in a few weeks.—Ed.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of January.

Vegetables.

PULL up everything that is not likely to be productive or profitable, such as old peas, beans, cabbages, and other vegetables which have run, or have started to run, to seed. Strawberries, which are generally grown in the vegetable garden, are likely to send out runners from all sides, and if some good plants are required for putting out in new beds next autumn, take the opportunity of selecting the best of the suckers, which will probably be found next to the mother plants, and remove all others. As soon as the suckers have become well rooted, separate them from their parents by cutting the connecting links. Should the weather continue favourable, the young strawberries, if nicely rooted, may soon be planted out, without waiting for the autumn, and it is quite possible that some of them may bear fruit before the winter sets in. When planting, or, rather, after planting, tread the soil well about the roots and spread a mulch of dung all around the plants, as it is quite possible that some hot, dry weather may set in after all; although there may be a risk in planting, it is worth chancing, for so much time may be saved.

Beans.—Any kinds, except the Windsor, or broad bean, may be sown as extensively as may be required. It would not be advisable to sow beans on the same ground from which beans of any kind or peas have just been removed. It would be much better to try cabbage, or, better still, some roots, such as carrot or turnip, and the soil would have a complete change. By constantly growing the same kind of vegetable, or vegetables belonging to the same natural order, as it is called, on the same piece of ground, not only does the soil become "sick" of them, but vegetable pests, insects and fungi, which are common to the natural order, have a much better chance of thriving and increasing than would otherwise be the case. Try some of the runner beans, if sticks or other supports can be provided for them. These can be sown either in single or in double rows, about a foot or so apart. The little labour entailed in fixing up supports should not deter anyone from growing a few rows of these beans.

Broccoli.—Sow a little seed of this vegetable, which is much the same as cauliflower, but rather coarser and hardier than that variety of cabbage. Like the cauliflower, it requires good, moist soil, well drained, and it is always advisable to use a good quantity of manure and thoroughly incorporate it with the soil when preparing for planting. This vegetable should be grown without a check if possible.

Borecole, or Kale.—This is another member of the cabbage family, and needs much the same management as cabbage, applying abundance of manure to the soil, unless it be naturally very rich. It is worth a trial, particularly by those who live in the cool parts of the country. Sow a little seed.

Cabbage.—Sow seed occasionally—just a little—in order that a supply of plants may be available for pricking out, and for planting whenever required. Sow the seed in drills, in a small seed bed, quite thin. The generally adopted but erroneous method of sowing cabbage seed is broadcast, as thick as possible, with the result a miserable lot of lanky-looking plants, to be hauled out by the handful when required for planting. Well-grown plants which are ready should be planted out.

Cauliflower.—Treat as recommended for broccoli. The seed may not, perhaps, come up so well as the broccoli, for it is a difficult matter sometimes to procure good cauliflower seed. It is worth while paying top price for the small quantity that is likely to be required.

Cucumber.—Seed may be sown in any part of the State if plants are required, and during such a season as the present the growth of the cucumbers should be most satisfactory.

Celery.—This should be growing very well under the favourable weather conditions lately prevalent. Sow a little seed. Prick out advanced seedlings, and plant some of the pricked out well-grown seedlings. Earth up any plants which are nearly full grown, taking care not to drop any soil within the leaf stalks.

Cress and Mustard.—Sow occasionally during the month to keep up a supply. These salads should attain great perfection with showery and cool weather.

Egg Plant.—Probably a sufficient supply of seedlings have been planted. But should any more plants be required, sow a little seed, which should soon come up after sowing.

Maize (Sweet or Sugar).—Advanced plants should be sufficiently well cultivated to keep down all weeds. More seed may be sown if a further supply is required.

Onion.—A little seed may be sown if an additional supply be required. Seedlings which are coming up above ground should be kept quite free from weeds. The weeding must be carefully done or the little onion plants may be pulled up with the weeds if they are thick. In small vegetable gardens the system of sowing onions for transplanting is a good one, and if carried out a good deal of trouble may be saved in the way of weeding, seed sowing, &c. The seed can be sown in small beds, or in boxes if this should be more convenient, and when the onions are large enough to shift they may be planted out. If the soil is at all dry, the onions should be well watered after planting.

Parsley.—A little seed may be sown if there are no plants in the garden.

Peas.—The season is all that could be desired for the pea. It will probably be found that the vines have grown much taller than usual, and, unless sticks have been provided sufficiently tall, the peas have

grown into a tangle. Those vines which are allowed to grow over the ground are even worse, and are liable to rot and die off, and a good deal of loss is the consequence. Some kind of support should always be provided for peas and other climbing vegetables. A few seeds may be sown two or three times during the month, or when space is available.

Potato.—Plant out a few rows of this most useful vegetable. Use abundance of farmyard manure, and mix it well with the soil as digging is proceeded with. When planting, try spreading a good layer of dung along the bottom of each trench, and plant the potatoes on the dung. Give the plants ample space in which to grow. The rows may be made from 2 feet 6 inches to 4 feet apart. Lay the sets about 1 foot apart in the rows, and let them be covered about 5 or 6 inches deep with soil.

Pumpkin.—The plants should be spreading well over the ground by this time; but should a sowing have been overlooked, seed may be planted at any time convenient, and a good crop is likely to follow.

Radish.—Sow a little seed now and then to keep a supply going.

Spinach.—Sow a little seed.

Tomato.—If any more plants are required, seed may be sown, or seedlings already suitable for moving may be planted out. There should be a good show of fruit by this time in many parts of the State. Plants which have been allowed to spread over the ground are not likely, during a moist season such as the present, to ripen their fruit satisfactorily; they should be trained to stakes or other kinds of supports. There are various methods of training adopted by different growers. Some train to a single stem, pinching off lateral shoots as they start into growth; others train, allowing the lateral shoots to develop, and so on.

Protecting Hay Sheds and Stacks from Mice.

Mr. B. G. Rodwell, of Ferndale, Kareela, writes: "In connection with the article in October issue respecting measures to protect hay sheds and stacks from mice, I have erected, at a nominal cost, a shed that is perfectly mice-proof. It is built of slabs with iron roof. The floor is about 2 ft. 6 in. from the ground. Round the posts below the floor I have galvanized-iron shields, cut in the shape of flat rings about 8 inches wide. These are nailed around the posts, sloping at an angle of about 45 degrees, so that they are like an inverted dish."

Mr. Rodwell states that his shed has been in use for over twelve months, and he has so far not found any trace of mice. The method suggested is a simple and practical substitute for the plan of putting a shed on piles, with a broad dish like a milk pan laid upside down on top of the pile, so as to cut off any connection with the floor plates. Buildings so constructed might be erected at a height sufficient to allow of the space between the floor and the ground being used for the shelter of ploughs, harrows, &c.

General Notes.

Burrless Clover.

In districts where there is much "burry" clover, great loss is sustained by the wool-grower through the burrs clinging to and becoming embedded in the fleece of sheep. Mr. R. N. Blaxland recently brought under notice a fleece from which the illustrations now shown were reproduced. As the pieces and bellies coming from those portions of the State where the "burry" clover grows prolifically, frequently carry from 20 to 35 per cent. of burr, it will be seen at a glance what an enormous difference in returns for the wool clip would be secured if only the burrless variety of clover or medicks (described by Mr. J. H. Maiden, in the *Agricultural Gazette* for January, 1894, and now illustrated on the next page), had spread with the rapidity of the "burry" clover. Burry pieces and bellies, which in the present wool market are now realising 3½d. to 4½d. per lb., would, if free from burr, fetch 6d. to 7½d. per lb. But perhaps the greatest losers at the present time are those wool-growers whose clips would suit the American orders, only the presence of burrs

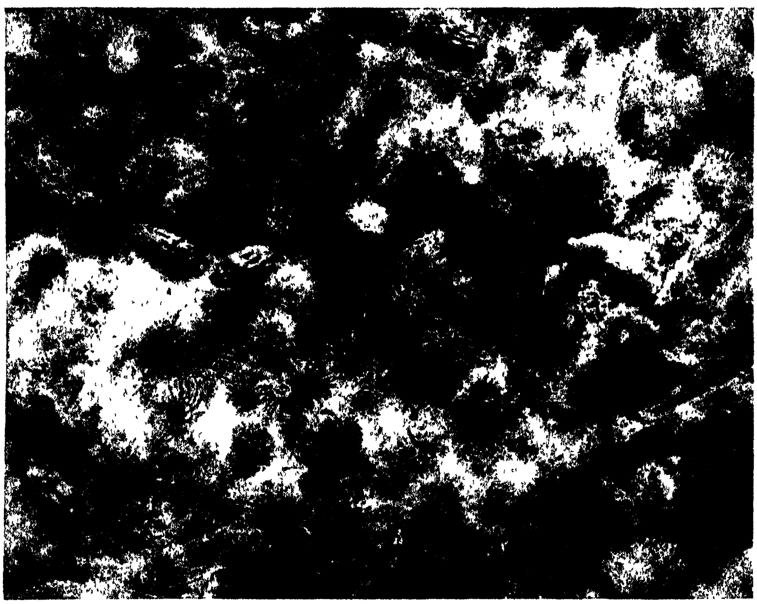
A "Burry" Fleece.

Medicks.

Fig. 1.—Medicago orbicularis, Allioni.
Fig. 2.—Medicago scutellata, Bauhin.

in the fleece absolutely debars the buyers from that quarter competing for it.

Mr. Blaxland considers the present season an opportune one to bring forward the value of a burrless clover, as the disparity in price between "free wools" and "burry, seedy wools" is very marked; the strong American demand having put the superior free wools pence a pound above wools which are similar in all respects except that they are infested with burr. Mr. Blaxland has tried the burrless clover and finds that it grows quite as freely as the "burry" kinds. At Calga station, in the Coonamble district, Messrs. Ryder have devoted a great deal of attention to the propagation and dissemination of burrless clover, and find that it is in all respects as good a food and will spread as well as the objectionable varieties. The seed pod, as shown in the illustration, is absolutely without hooks, and is much



Piece of the fleece showing burrs natural size.

larger than the burred pod of other medicks. One observer reports having obtained 1,400 pods from a single plant, so that it will be understood, once a few plants were established, it would be a simple matter to procure a good supply of seed. A matter of importance to the wool-grower in this connection is that bellies and pieces from burry country carry as much as 20 to 35 per cent. weight of clover burrs, and the grower has to pay the freight on this extra dead weight from the seat of production to the seat of manufacture in Europe, as well as to meet the expense of the process of getting rid of the burr, which is known in the wool trade as carbonising. This operation is a very costly one. In it acids are used to eat up the vegetable matter, *i.e.*, the burrs and seeds contained in the wool, and they are thus reduced to a powder and freed from the wool.

These facts explain the difference in price realised for burry pieces and bellies and free pieces and bellies.

Turpentine Timber for Wharf Piles.

At a recent meeting of the Society of Civil Engineers in South Africa, Mr. F. W. Waldron, Resident Engineer of the Mossel Bay Harbour Works read a paper on "The Destruction of Timber on the South African Coast by Marine Wood-borers."

Mr. Waldron, who has had twenty-eight years' experience on harbour works on the South African Coast, after describing the various wood-borers, the principal one of which in South African waters, as on the New South Wales seaboard, is the *Teredo navalis*, or, as we call it here, Cobra. These worms are a continual source of expense wherever wharfs are built in waters they frequent.

Mr. Waldron furnished details of his experience and observation of the following woods, used in wharf construction in South Africa:—

Jarrah,	Knysna iron-wood,
Teak,	Do. yellow-wood,
Karri,	American Elm,

Pitch Pines and several kinds of Deal.

Of all these woods, Jarrah in an unprotected state gave the best results; an instance had, however, just come under Mr. Waldron's notice, where the end of a 12 x 6 Jarrah bracing was almost destroyed in twelve months. At East London, Jarrah piles 12 in. and 15 in. square were attacked by the Teredo and Limnoria (this is a sort of marine louse which jumps backwards on being disturbed; it is common enough even in Sydney Harbour).

The Acting Resident Engineer, Durban Harbour Board, says:—"Several kinds of timber from Australia have been tested from time to time, but none of them come up to sound Jarrah, with the exception of Turpentime (*Syncarpia laurifolia*) which, after being under test for two years' immersion, shows no signs whatever of being attacked. Karri does not stand the Teredo well. In some piles used for staging, nearly two-thirds of the cross-section had been bored in twelve months, the outside showing little evidence of the presence of the worm. At Robben Island, some Karri fenders, 12 in. x 6 in., were destroyed to a depth of 1½ in. by Limnoria in five years, but only a few Toredo workings were found in the same timber. At Mossel Bay the Teredo is practically active in all kinds of timber, more so, it is believed, than at any other place along the coast. The Limnoria has, however, not been found there.

At the invitation of the Chairman, Mr. Geo. Valder, Commercial Agent for New South Wales, addressed the meeting.

Mr. Valder said that in Australia, New Zealand, and South Africa, he had given attention to the question of timbers suitable for Harbour work, and as far as his knowledge went no timber resisted the action of the Teredo worm with the single exception of the Turpentine Tree (*Syncarpia laurifolia*). In the paper just read Mr. Waldron referred to an experiment with a Turpentine pile at Durban Harbour; this was he believed the only trial of turpentine in South Africa, but he was pleased to be able to state that in this instance it had proved a signal success. The engineer, Mr. Crofts, about two years ago, had this pile

raised—it had then been in the water a little over five and a half years—and although all the piles near it were badly damaged by the Teredo and Limnoria this Turpentine pile was as sound as the day it was put in. Mr. Crofts was so pleased with this result that he at once ordered 100 piles of from 50 to 55 feet in length, these had been used in connection with the Durban Harbour Works, and a further large consignment had since been obtained from New South Wales.

He next quoted a report from the *Sydney Morning Herald* of a test recently made at Newcastle, N.S.W., as follows :—

A test of Timbers.

"A test of timbers, the result of which should prove instructive to those interested in the erection of piers, wharfs, and other marine structures, recently took place at Newcastle, New South Wales. The timbers experimented on were the Turpentine of that State and the Jarrah of Western Australia. By some it had been advanced that the Jarrah was without equal among the hardwoods of Australia as a marine insect-resister, and that it survived, in the shape of piles, etc., the assaults of the *Teredo navalis,* where other timbers were bored through and reduced to rottenness. In order to test the value of this supposition, the West Australian Government in 1897 forwarded a Jarrah pile to the Public Works Department of New South Wales. This pile, together with one taken from the Turpentine tree of New South Wales, was put down in Newcastle Harbour in August of that year, and after six and a half years' submergence in waters thickly infested with marine borers the piles were raised for examination. The result proved a revelation ; for while the Toredo had honeycombed the Jarrah through and through, the Turpentine pile remained practically unharmed. The Turpentine, therefore, as a result of this test, is entitled to first place among the hardwoods of Australia, as a pest-resister in infested waters."

"The experience of the use of this timber in Australia was very gratifying. Turpentine piles, dressed only in their own natural clothing of bark, have been known to preserve their soundness in Teredo-infected waters for a period extending to over thirty years. Oregon pine in the same locality has been eaten through and through in less than six months. The preservation of the Turpentine is attributed to a layer of oleo-resin, which lies between the bark and the sapwood, but even the sawn wood appears to be highly resistant, as it is found that the flat-bottomed boats, used in bringing the produce down from the shallow reaches of the Teredo-infested waters, if made of sawn Turpentine, although unprotected, last for twelve to fifteen years, whereas the same boats if built of other hardwoods often will not last twelve months. It has been noticed that seasoned Turpentine timber becomes very flinty, and difficult to plane; no doubt, this to a certain extent, accounts for its resistance.

"Numerous instances can be quoted of Turpentine piles put down in infested waters, lasting for a great number of years. At the Commercial Agency of the N.S.W. Government in Durban, there is a portion of a pile taken from the Pyrmont Bridge, Sydney, which was

for forty-eight years in use in water known to be thickly infested with sea worms, and which when raised was found to be perfectly sound. Other specimens have been in the water for from twenty to thirty years, and yet the wood is in splendid condition. On the south coast of New South Wales there are some few jetties built in such a position that they are exposed to the full force of the ocean; the piles of these jetties are nearly all of Turpentine. Two of these, the piles of which

Section of Western Australian Jarrah Pile, 4ft. 3in. in Circumference. Forwarded for Test at Newcastle.

The above are the piles referred to in the extract from *Sydney Morning Herald*, quoted by Mr Valder. Both piles were driven in August, 1897, in Newcastle Harbour, two miles from entrance of Port Hunter, and were drawn in February, 1904. Sections shown were taken between high and low water mark.

are Turpentine, are used for coaling, they cost £20,000 and £12,000 each, they reach a great height above high water and have to carry heavy train loads of coal. They have now been in position upwards of twelve years and have required no repairs to the piles and other parts which come in contact with the water, whereas similar structures near these, built of other hardwoods, were badly damaged by the sea worms in the course of two or three years.

"Turpentine is essentially a pile timber, growing as it does with a long straight trunk to great heights. It is plentiful and as it is found in the coast districts it can be supplied at a low cost.

"Arrangements are being made to use this timber for piles at Delagoa Bay and several other South African Ports, but so far, I am sorry to say, that there are no specimens in the Table Bay Harbour Works to which I can refer you.

"Although Turpentine is considered unequalled as a pile timber, our engineers do not recommend using it for general purposes, as they find it better to use certain timbers for the purpose for which they

Section of New South Wales Turpentine Pile, 3ft. 6in., from Port Stephen's District, N.S.W.

are specially suited. Mr. J. V. De Coque, Engineer and Timber Expert to the N.S.W. Government, recommends the following:—

"For bridge and wharf construction and other public works, in square girders, corbels, &c.—Grey Gum, Tallow-wood, Blackbutt, Brush and Grey Box. For round and square piles in general bridge work (when not in situations where the piles would be exposed to the attacks of sea worms)—Grey Gum, Tallow-wood, Blackbutts and Grey Box. For round piles for wharfs and other submarine structures—Turpentine. For bridge and wharf decking—Grey and Brush Box, Tallow-wood and Blackbutt. Mr. De Coque states that these timbers, if given an even chance, will prove themselves much superior to all other Australian hardwoods for wharf and bridge construction."

Excessive Cobbing of Maize.

A reader of the *Gazette* wants to know if there is any way of preventing maize from sending out too many cobs. If he gets a sample of maize to plant, it is all right the first year, but the next year it sends out about three cobs to the stalk, and gets worse every year. This is detrimental to the crop, especially on rather poor land, as there are often six or seven husks on one stalk, and not one cob worth the pulling. Mr. Marks, Experimentalist at the Hawkesbury Agricultural College, reports that poor soil, or soil which has been exhausted through growing a gross feeder like maize continuously, year after year, without the application of any manure, would produce a crop such as the one complained of. At the same time, it happens occasionally that good varieties in rich soils will give poor results if dry weather should set in at time of cobbing.

To get poor or exhausted soil into proper condition for the production of normal, good crops of maize, Mr. Marks considers that the first step should be to get it into good heart by deep ploughing, and thorough cultivation. As manure, superphosphate and bonedust, mixed in the proportion of one part superphosphate to two parts of bonedust, and applied at the rate of 2 cwt. per acre, will be beneficial. Much, however, could be done to improve poor maize land by the practice of rotation of crops. For the North Coast districts, cowpeas are a very useful and profitable crop for improving maize land. They are scarcely to be considered a monetary crop, but the great quantities of green fodder produced can be turned to profitable account in the feeding of cattle and pigs. Where a soil is naturally poor, or has become exhausted by too long cropping with the one class of plant, it is, of course, realised that returns do not justify expenditure sufficient to do at once all that may appear necessary. Green crops, of the pea or bean family, for fodder are therefore to be recommended as a good means of building up the soil, as there is not a large outlay for fertilisers, and there is something coming off the the land all the time.

The Destruction of Sparrows.

Attention is called to the circular accompanying this issue requesting the co-operation of readers of the *Agricultural Gazette* in collecting data with a view to devising the most effective means of checking the sparrow pest.

WHEAT-GROWING IN THE ARGENTINE REPUBLIC.*

THE Argentine Republic, though still far behind the United States, may now be regarded as competing for second place as a contributor to the wheat supply of Britain. The quantity received annually, on the average of the past five years, has been 574,000 tons, compared with 2,960,000 tons from the United States, 520,000 tons from Canada, and 335,000 tons from Russia. In the first seven months of 1904, moreover, the total import of Argentine wheat exceeded that from any other country, outstripping, probably for the first time, the combined receipts from the North American continent. Fifteen years ago the Republic had hardly become a competitor in this trade, and although the progress since 1894 has not been so rapid as it was a few years earlier, the great possibilities of development which the country undoubtedly presents makes the question of Argentine agriculture one of interest to the New South Wales wheat grower. The actual area devoted to the crop, according to the official figures for 1903–4 was 10,485,000 acres, which may be compared with the area of 5,063,000 acres returned by the Census in 1895. The preliminary estimate of this year's production from the above area was 3,700,000 tons. An interesting feature in connection with the development of the wheat area, and one which has in the past, to a certain extent, restrained the increase in the acreage, is the change which is taking place in the centres of production. Much of the land which has been, and still is, cultivated for wheat, lies in the northern part of Santa Fé, in a region liable to drought and excessive heat. Experience, however, has shown that the best wheat land lies rather to the south and south-west, in the province of Buenos Ayres, and in the more southern portions of Santa Fé and Cordoba; the extension in this direction has recently been very marked.

The areas devoted to wheat in the four principal provinces of Argentina during the past six years are shown in the following table (in thousands):—

Year.	Santa Fe.	Buenos Ayres.	Cordoba.	Entre Rios
	Acres.	Acres.	Acres.	Acres.
1898-1899	3,581	1,929	1,410	583
1899-1900	3,690	2,015	1,381	707
1900-1901	3,663	2,265	1,548	695
1901-1902	3,417	2,403	1,440	695
1902-1903	3,106	3,249	1,893	650
1903-1904	3,314	4,061	2,329	521

It will be seen from this that while the area devoted to wheat in Buenos Ayres increased from 1,929,000 acres in 1898–9 to 4,061,000 acres in 1903–4, the area in Santa Fé declined over a quarter of a million acres in the same period.

* From a report in the *Journal of Agriculture*, England, September, 1904.

The yield of wheat is much better in Buenos Ayres than in the other provinces, as will be seen from the following average yields, estimated by the Argentine Department of Agriculture:—

	Bushels per acre.
Sante Fé, north and centre	10·63
Sante Fé, south	13·24
Cordoba, south	13·01
Entre Rios	12·03
Buenos Ayres, north	14·98
,, ,, centre	17 68
,, ,, south	20·26

In 1901–2 an average yield of 15 bushels was obtained in Buenos Ayres, whereas the other three provinces were so affected by the drought that a yield of only 5 bushels was obtained in Santa Fé, $3\frac{2}{3}$ bushels in Cordoba, and less than 7 bushels in Entre Rios.

A question of considerable economic importance is the cost at which wheat can be grown under the conditions prevalent in the Argentine and placed on the British markets.

The writer of this report observes that the difficult feature of the study of wheat production in Argentina is to tell what it costs. Some idea of the average value of farm land and rent may be obtained, but wages fluctuate so much, and different farmers, with different ideas and under different conditions, give such widely varying estimates of the amount of labour required, that a satisfactory estimate cannot be made. The cost of the labour necessary to produce wheat in Argentina is still more difficult to estimate, because three-fourths of it is performed by members of the farmers' families, young and old, of both sexes. Three estimates, however, are given in the following table of the cost of producing 1 acre of wheat. The first (A) is the estimate of M. Tidblom, Director of Agriculture and Animal Industry; the second (B) is an estimate prepared by M. Lahitte, Director of Statistics in the Ministry of Agriculture; and the third (C) is a statement by Mr. Glynne Williams, an English *estanciero* in the province of Buenos Ayres, of the actual cost of producing the crop on 3,678 acres in 1902–3. In the first of these estimates the work is, presumably, chiefly or entirely performed by the farmer and his family, whilst in the other two labour is allowed for.

COST OF PRODUCING ONE ACRE OF WHEAT.

	A.	B.	C.
Quantity produced, in bushels	18	22	16
	s. d.	s. d.	s. d.
Ploughing, harrowing, rolling, and sowing	3 2½	4 7½	7 6 (Ploughing … and Seed)
Seed	3 3	3 2½	
Harvesting and stacking	3 4½	5 11	8 10
Threshing	7 3½	10 5	9 4 (Threshing and Bags)
Bags	2 6	2 10½	
Hauling to railway station	0 11	3 9½	3 7½
	20 6½	30 10	29 3½

The above figures are exclusive in each case of rent or interest on value of land. Rent in Buenos Ayres is said to range from 1s. 8d. to 16s. per acre, but Mr. Bicknell, who visited and reported upon the industry on behalf of the United States Government, states that, from his own observation, the best wheat land is let at from 2s. 11d. to 8s. 4d. per acre, except that near the city of Buenos Ayres. A minimum sum, therefore, of 3s. must be added to the above items, so that the cost would seem to range from 23s. 6d. to 33s. 10d. per acre. In the first estimate (A), however, there is probably no allowance for the farmer's own labour or cost of living, while in the second (B) the production is above the average. In the third of these estimates, which represents the actual ascertained cost over a considerable area, the rent is stated to be 2s. 11½d. per acre, and the cost of raising an acre of wheat, including all expenses, as 34s. 6½d., or almost 2s. 2d. per bushel. This, however, was in a somewhat unfavourable season. In the previous year a yield of 20½ bushels was obtained at a cost of 36s. 2d. per acre, so that the cost was 1s. 9½d. per bushel.

Comparing these figures with those of ten years previous, it would seem that there has been some advance in the cost of production since 1894, as it was then estimated that, making every allowance for rent, living, interest on capital, and depreciation, the cost, assuming a production of 15 bushels, would represent an outlay of from 21s. to 25s. per acre. Mr. Gastrell, at that time H.M. Vice-Consul at Buenos Ayres, stated that the cost appeared to be about 21s. per acre, while several authorities quoted by him placed the cost at from 13s. 4d. to 17s. 6d., exclusive of rent, cost of living, and interest on capital. It must be remembered that about three-fourths of the wheat raised in Argentina is grown by people of the class who depend on family labour, colonists from Italy, Spain, Russia, and other countries in Continental Europe, and that their standard of living is very low. In the opinion of many observers the profits of this class of Argentine farmer merely represent the privations and low order of living which he endures. The other 25 per cent. is grown on large farms, frequently owned by Englishmen, where the work is usually done by contract, and hired labourers are more generally employed. The farm referred to above, owned by Mr. Wynne, is an example of the latter class.

About 35 per cent. of the farms in the four provinces are farmed by the owners, 50 per cent. by ordinary tenants, and 15 per cent. by tenants on a share system, known as the *medianero* system. The tenant on this system starts with a capital of a few pounds, and it is usually easy to find a land-owner who will give him land, a mud hut to live in, horses, bullocks, implements, and seed to start farming on his own account. He and his family prepare the land, sow and harvest the wheat, and it is sold by the land-owner at his discretion. After deducting the cost of the bags, binding-twine, and threshing, as well as the seed, the proceeds are divided between the tenant and the owner, usually in equal proportions.

There are three principal varieties of wheat grown for export, the Barletta, the Russian, and the Hungarian. The Barletta is an Italian variety, closely resembling American red hard wheat, though not so

hard. It is the favourite sort in all parts of the country, and has shown its superior adaptability to various Argentine conditions through many years. Millers in Argentina and in Europe prefer Barletta, though they often mix French with it to give it colour. An analysis made in 1891 showed 17·07 per cent. of gluten. It is a heavy wheat, and a sample shown at Buenos Ayres in 1903 weighed 66·19 lb. per bushel. The Russian is next in popularity, and gives from 60½ to 65¼ lb. per bushel. The Hungarian is of more recent cultivation.

After the wheat leaves the farm it meets with many difficulties, such as bad roads, absence of warehouses or elevators, shortage of railway cars, and inadequate facilities at the shipping ports, which tend to reduce the price paid to the farmer for his wheat. The storage of the grain at the stations pending loading into the cars has recently been dealt with by a law passed on September 17th, 1903, which requires that all railway stations in agricultural districts shall be provided with free storage for all cereals offered for shipment. Up to the present the wheat has been stacked in great piles of bags, and it is generally sold to some regular buyer for cash at the station. The shelters which are now to be provided have to be of sufficient capacity to protect all cereals delivered for transport from the inclemency of the weather and the damp from the ground. The Government will fix the minimum capacity of each shelter, and the railways are not to make any charge for this service. The date for the fulfilment of this regulation expired in May last, and, if it has been complied with, the cereals will have safe shelter where they can wait till such time as trucks are available.

The question of the alleged shortage of railway trucks has recently been the subject of a report by M. Lahitte, the Director of Statistics of the Department of Agriculture, and he observes with regard to the provision of shelters that "if consignors do not find their demands acceded to in the matter of quick despatch, they will, at least, have assured to them the preservation of their produce." With regard to the provision of railway trucks, the lack of facilities at the ports leads to the slow discharge and consequent delay in the return of the cars. The cost of transport on the Argentine railways was, according to the official statistics, 6s. 8d. per ton per 100 miles.

Establishment of Terminal Elevators.

Large elevators, however, have now been built at Buenos Ayres, which enable the loading to be done much more rapidly; at Bahia Blanca, also, the only seaport, the railway company which controls the port is building elevators and making extensive improvements.

The actual railway rates in the province of Buenos Ayres charged between some of the principal inland stations and the ports of Rosario, Buenos Ayres, and Bahia Blanca, ranged from 2½d. to 4¾d. per bushel; that is, roughly, from 7s. 9d. to 14s. 8d. per ton, while from certain places in the other provinces the cost would be considerably greater.

DRIED MILK.

SOME months ago Mr. T. T. Ewing, M.H.R., brought under the notice of the dairy farmers of the north coast districts, through the Lismore Chamber of Commerce, the question of dried milk. It appeared to Mr. Ewing that if by any reliable process dairymen could cheaply produce an article which in concentrated form could be carried at small cost of freight to any market, it would be of enormous monetary advantage to them.

The process mentioned by Mr. Ewing as worthy of careful investigation was the Just-Hatmaker process of drying milk so that it could be disposed of in the form of a powder. This invention has also come under the notice of Mr. C. C. Lance, Commercial Agent in Great Britain for this State, and appears to him likely to become very important.

The process consists of passing fresh milk over hot rollers, and so almost instantly evaporating all the moisture from it. As the milk comes off the cylinders it is packed (in the form of powder) in tins or boxes, and may be carried anywhere as ordinary cargo. Mr. Lance understands that the demand for the article is very great in England, and is likely to increase.

He forwarded samples consisting of—

A tin of whole milk, dried.

A tin of half-and-half, *i.e.*, half fat extracted.

The samples were submitted to the dairy expert, Mr. M. A. O'Callaghan, for bacteriological examination and report. Mr. O'Callaghan found the milk to be practically sterile, and when dissolved, by first making into a paste with water at 100 degrees and then adding more water, the fluid is fairly pleasant to taste.

The Commercial Agent in London forwarded with the samples of dried milk a report by Dr. W. S. Magill, M.A., formerly bacteriologist of the New York University, and now Chief of the Research Department of Carnegie Laboratory, New York. It appears from this report that in September, 1902, while the staffs of the Carnegie Laboratory and the laboratory of the Department of Health of New York City were engaged with the study of milk contamination to devise means for securing to the public, and more especially to infants and the young, a pure and sterile milk supply, two distinguished scientific investigators, Messrs. Just and Hatmaker, presented a new dried milk which they claimed was pure, indefinitely conservable, and absolutely sterile.

It was in the form of a light, yellowish, flaky powder which had the natural taste and odour of milk. It was easily brought back to liquid milk of excellent quality by adding water, and was obtained by drying milk rapidly at high temperature. Milk to be dried by this process is fed continuously between two steam-heated cylinders revolving inversely and having a surface temperature in excess of 212° F. It passes between the cylinders (which are slightly separated), and is spread out in a thin uniform layer or film upon each cylinder and exposed thereon until reduced almost to dryness, being removed by a

knife-edge while the film of milk solids yet retains sufficient moisture for their preservation. The milk solids come off the drying rolls in continuous moist sheets, which become dry instantly upon cooling, and are easily reduced to a uniform powder by being passed through a sieve.

Having passed successfully all bacteriological tests, this dry sterile milk was subjected to physiological tests to determine its digestibility.

In connection with the officers of the Department of Health of New York city, and with the directors of several charitable societies interested in the rearing of infants, extensive infant-feeding tests were planned during the early part of last summer. A number of physicians were appointed to supervise, with close attention, the feeding of about 850 children ranging between five days and two years of age. They were average children, in good health, living for the most part in the poorer tenement house districts of New York city. They were fed exclusively with milk made from this dry sterile milk. In some cases the dry milk used was obtained by drying full-cream milk, but in the greater number it was obtained by drying mixtures of full-cream milk and of separated milk ($\frac{2}{3}$ full-cream and $\frac{1}{3}$ separated, or $\frac{1}{2}$ full-cream and $\frac{1}{2}$ separated). Sugar of milk was added according to the age of the infant, eleven different formulæ being used to meet different requirements and the ideas of the physicians in immediate charge. The experiment was made during the three hottest months of summer, when infant mortality in New York reaches its maximum. A number of medical students, carefully trained for the work, assisted the physicians in charge.

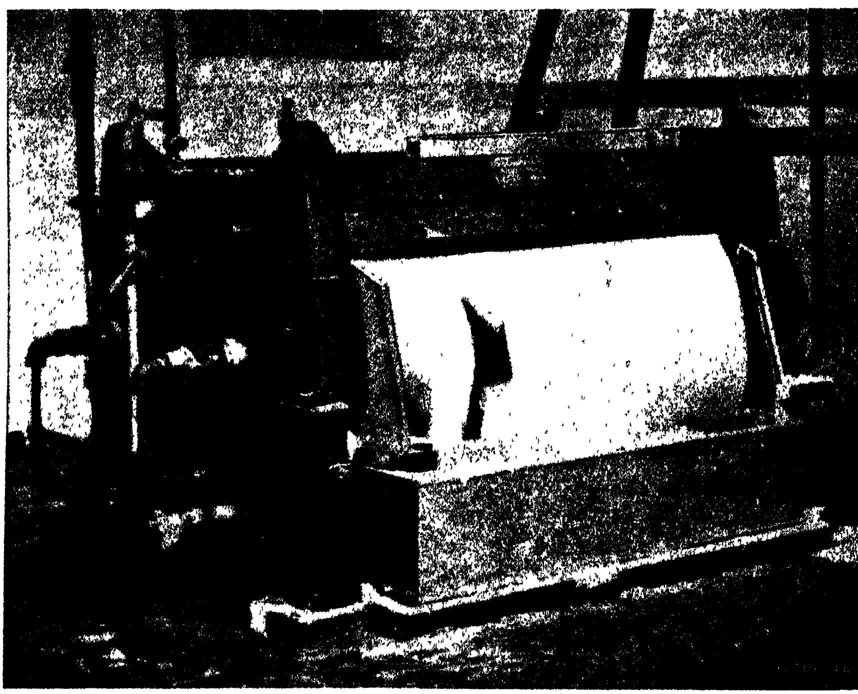
Where the mother was sufficiently intelligent, a box containing about one pound of the dried milk was left with her, with instructions to put so many teaspoonfuls of it into the feeding bottle, and dissolve it by adding a stated quantity of hot water. The hours of feeding were indicated, and it was imperatively ordered that *every portion of the reconstituted milk that was not taken by the infant at the time it was made was to be thrown away.*

In a large number of cases, where the mother was either unintelligent or careless, or the sanitary conditions of the home were unfavourable, the portion of dried milk necessary for each feeding was left in a sealed envelope, not to be opened until the time of feeding. Then the corner of the envelope was to be torn off and the contents poured directly into the feeding bottle, the requisite quantity of hot water added, and the milk thus reconstituted given at once to the child. This prevented any handling of the powder, and ensured warm feeding of the milk. It was invariably required that all unused milk should be thrown away.

The results of these feeding experiments upon 850 young children from the poorer districts of a great city are absolutely unparalleled in medical literature. *Not one child died.* With one exception all of the children gained regularly in weight—from $1\frac{1}{4}$ to 6 ounces per week. The exception was that of a child which during five days lost about three ounces, but which recovered and later re-established its good average.

These practical experiences brought out the important fact that this dried milk, when reconstituted into liquid milk by the addition of water, forms a milk which does not clot in the stomach in large clots like ordinary liquid milk, but in fine granular clots which closely resemble those formed in human milk. This renders its digestion much easier and more complete.

As Mr. Ewing points out, milk is at present retailed in Sydney at something like 3d. a quart for small quantities. The amount which is obtained for milk, if utilised in production of butter and cheese, is well known to all employed in the industry to be out of all proportion less than this price, and may be stated generally as being not one quarter thereof. Thus far science has not been able to furnish a process by which milk can be carried profitably any considerable



The Milk-drying Machine.

distance in its liquid state, so that producers near centres of population have an enormous advantage in price over producers outside the limit of successful carriage. If an article can be produced and carried cheaply, it will furnish all parts of the world, no matter how isolated, with good milk, increase the value of milk to the dairyman, and furnish another marketable product for him. Milk consists of about 4 per cent. butter-fat, 4 per cent. casein, 4 per cent. milk sugar, a little milk salt, and about 87½ per cent. water. The problem was, therefore, to obtain the solids in a form which would, when hot water was added, return to the same status as a food and article of diet as prior to the evaporation of the water. I have had an opportunity of reading opinions expressed by scientific experts, and statements with

regard to practical tests of the dried milk. In various parts of Europe it is coming into favour, and in the Argentine a large company has been formed to supply local demands, and also the South African market. The questions to be decided are:

1. Has dried milk, in preparation, retained the food properties of fresh milk?
2. Will it keep?
3. Can it be cheaply and rapidly produced?
4. Will it be palatable as a food?
5. Can it be used for any purposes for which milk is used?
6. Is it sterile?

1. There does not seem to be any doubt with regard to this. It is attested by an able pathologist, and seems to have stood a full practical test.

2. There seems to be no doubt with regard thereto; the tests seem ample.

3. It being an evaporation process under heat, thence passing through rollers, the production is a cheap and speedy one. The machinery is simple, being a drying process at a temperature of greater than 212 Fahr., thence passing over rollers. It is claimed that the process takes less than half a minute. The machinery would cost about a couple of hundred pounds (£200).

4. It is claimed that it is so. In my opinion, although the boiling seems to have altered it somewhat to the taste, it is quite as palatable.

5. Evidence with regard to this seems to be satisfactory, not only for consumption as milk, but it can be used for all alimentary foods, by bakers, confectioners, and others.

6. There appears to be no doubt with regard to this question. It is attested by a competent bacteriologist. The ease with which milk takes up microbes is well understood. This matter is very important.

"The foregoing information, no doubt, requires to be taken with caution, for some of it at least has been obtained from sources interested in the invention; but still I am forced to the conclusion that they are substantially correct. If it be all true, there still remains the difficulty of inducing the public to use a new article. Public taste counts for much. As an example of this I would point out that wheat which is regarded as most acceptable for breadmaking in the south of Scotland might be almost unsaleable for the purpose in the south of England, and so if this dried milk varies materially in taste from the product to which the people have been accustomed, it may be a considerable time before they can be induced to fully make use of it. There appears, however, to be great potentialities in it. If it were possible to obtain even half the price, say 8d. per gallon, now paid for fresh milk in small quantities for even a proportion of the milk produced in the district, it would be an enormous advantage to our producers, while to the consumer it would mean a much cheaper article. The bulk of fresh milk renders carriage, not only on railway and steamers, but for purposes of distribution, expensive. Its liability to contamination always carries with it a considerable element of danger."

THE SANITARY ARRANGEMENTS OF FARM AND STATION HOMESTEADS.

IT is by no means uncommon to find throughout the State the sanitary arrangements of farm and station homesteads of a rather primitive character. Not infrequently these places are so offensive that there is nothing for it but to place them at quite a distance from the house, which causes a good deal of unnecessary discomfort and inconvenience. There is however even a more serious side to the matter than that of personal convenience, and that is the excreta festering in a pit or pan that is not treated in any way and emptied as seldom as it is only natural to expect such an unpleasant job will be performed, is an excellent breeding place for blow flies. In another part of this issue, the Entomologist describes the injury that even the common blow fly may do to sheep already infested by the more serious pest by blowing the wool. Under such circumstances, it is well worth the while of pastoralists and farmers to get any information possible as to practical means of overcoming the evils arising from unsatisfactory sanitary systems. In a recent issue it was suggested that in some cases where ample water was available, the septic system might be inexpensively adopted. Where the water is not easily available, it appears that the dry earth system could be introduced with satisfactory results. For the information of those interested, the following notes on the matter have been obtained from Mr. P. Gibbs, an authority on the subject:—

Most people in the country regard the closet as a necessary evil. It should be a no more objectionable out-house than the barn, and a deal less offensive than the stable. For forty years in England, not to mention other countries, the simple dry-earth system, introduced by the Rev. Henry Moule, has proved that contention. To come nearer home, I might quote the opinion of Dr. William Armstrong, the City Health Officer of Sydney, who says:—"Pail closets are always more sanitary than cesspits. But they must be properly constructed, and should always be worked with dry earth. The earth system consists in the use of dry earth supplied in detail to fresh human excrement and in the subsequent frequent and regular removal and use of the mixture for agricultural purposes. By use in detail is meant the small quantity of earth with each separate dejection. The earth should be dry, and consist of good garden soil or humus. Sand is not so good as loam. Ashes are also less satisfactory than loam, but may be used where loam is difficult to get. About 1½ lb. of earth should be used with each dejection, and this quantity completely deodorises the excreta. In estimating the usefulness of earth closets, it must be remembered that by their use a large amount of valuable fertilising material is saved and made use of, which in sewered districts is lost. The dry earth method, remember, is the best development of the conservancy system of dealing with nightsoil." The two concluding sentences should be noted with interest by the man on the land, and I shall enlarge upon them later on in this article.

My first purpose is to speak of the dry-earth system as a simple, most economical, and perfectly sanitary method of dealing with night-

soil. The proper working of the dry-earth system renders the closet a quite inodorous apartment, to which flies are never attracted. (What a difference to the ordinary country closet!) I speak of flies, because it is well understood that they are instrumental in spreading typhoid germs, which they get from the ordinary night-pail or cess-pit. If the editor will permit me, I can say literally that there are no flies on dry-earth closets. Because of its offensiveness, the closet in most country houses is now placed at an inconvenient distance from the house, so that in bad weather, and at night, it is misery to the healthy to be compelled to use them—and what about the sick? A properly-constructed earth-closet may be erected on your back verandah. But let us return to the system.

It is conceded by all medical men and chemists that the earth has power to render dead organic matter perfectly innocuous; applied to fresh fœcal matter it immediately hides it from sight and smell. This is the first and mechanical effect; but now comes into operation an absorbing and disintegrating process that results either in the total disappearance of the fœcal matter, or its conversion into a substance as little loathsome as are lumps of earth or stone. Chemically, the action is that of slow oxidation, the ultimate result being the production of a mass of carbon (or humus) not greatly dissimilar from the product of combustion (which is rapid oxidation), but accompanied by certain by-compounds of nitrogen.

Moreover, since finely-sifted dry earth supplies those conditions of æration and desiccation which are allowed to be unfavorable to the active vitality of disease germs (microbes), it must be conceded that earth in that condition is what it is alleged to be, namely, a true disinfectant, having power to render disease-bearing fœcal matter harmless, the reason being found in the fact that fine, dry virgin soil has power to filter microbes out of the air which permeates it, to engage in successful battle with the bacteria in excreta. The anti-septic property of earth is so well recognised that mud baths are esteemed an active therapeutic agent, and the same principle is involved in the application of Fuller's Earth in cases of dermal inflammation.

In testimony of these statements I would quote Dr. Mouat, of the Indian Medical Staff, author of "Hospital Construction," a recognised text book, who says:—"Dry earth, containing organic matter, is a perfect deodorizer of all excreta, and the aid of vegetation prevents all further chemical change of an injurious nature. Our prison experience in Lower Bengal proves the resultant to be a valuable manure, and the same experience has shown that in some gaols, which were formerly decimated by cholera, the disease is now nearly unknown. The dry-earth system was first introduced by me in some of the prisons under my charge in 1863. The sanitary advantages of dry sewerage are that putrefactive fermentation and its products are permanently arrested by some of the methods in use. The economic value is that all the constituents necessary for healthy vegetation, of which the soil has been robbed in the building up of vegetable bodies, are restored to it in a form well suited for the renewal of vegetation."

Speaking of emptying a night pail, Dr. J. Ashburton Thompson, the President of the Board of Health, in a pamphlet issued by the Board, says:—"It is worth while to mention that when a pail is properly served during the week with dry earth or ashes, the resulting mass is a compost which, at need, can be stacked without offence on a slab of stone or the like, under some slight shelter sufficient to keep it dry."

The opinions of many other eminent medical and sanitary authorities could be quoted, but space does not permit.

I would now point out the value of nightsoil that has been treated with dry earth. In a garden of about one-half of an acre in extent, for twelve or fourteen years an annual manuring of stable dung failed to produce anything like a crop. Peas would not grow. Cabbages were dwarfed. Neither celery nor rhubarb nor parsnips would grow at all. One year, as an experiment, the stable dung was abandoned, and "earth" manure was used. The first sowing of peas was destroyed by a too liberal use of the new manure. Subsequently, in consequence of a more economical expenditure of manure, the barren field was changed into a fruitful garden. The peas grew 7 feet high, and were covered with pods; whilst the white heads of the cabbages weighed 4 lb. and upwards.

In another case, to a quarter of an acre of Swede turnips was applied 1 cwt. of "earth" manure, which had passed five times through the closet. To three quarters of the same acre were applied 3 cwt. of superphosphate (at that time worth £7 10s. per ton). The turnips grown on the one-quarter of an acre dressed with "earth" manure, weighed one-third more than those grown on either of the three-quarters of an acre dressed with superphosphate. The whole crop was fed off; no other manure was used, and the following year the barley crop was finer on the one-quarter of an acre than on either of the three-quarters of an acre, in the proportion of four to three.

On another piece of land, earth which had passed seven times through an earth-closet, was substituted for crushed bones at the rate of 1 cwt. per acre. The ground was poor, the crop white turnips, and several good judges expressed the opinion that a finer crop could scarcely have been grown.

In the flower garden the effect of the manure in improving the colour of rose bloom, and increasing the softness and closeness of lawn grass, is very gratifying; few plants are not improved by a judicious supply, and so clearly is this recognised that the lover of flowers comes to regard the earth-closet chiefly as a manure-producing appliance.

The best manurial effect is not obtained by burying the contents of the receptacles as soon as removed from the closet; but by storing it up for a period, and then using it as a top dressing.

I have asserted throughout this article that the dry earth system is sanitary, simple, and economical; but I would conclude by saying that the system does not consist of throwing earth in the pan about once or twice a day, but in doing it every time the closet is used.

You cannot get all children to use a scoop, and many adults forget, so you should have an automatic apparatus to throw the earth when necessary. Such an apparatus is procurable, and the price is anything from £2 up.

I trust this article will be the means of bringing about a better condition of sanitation in some country homes.

Rabbit Destruction at Wagga Farm by means of Carbon Bi-Sulphide.

Mr. Geo. McKeown, the Manager of the Wagga Experimental Farm, has sent the following communication to the Chairman of the Wagga Pastures Protection Board in reply to a letter from the Board inquiring as to the cost of carbon bi-sulphide :—

From July 1, 1901, to June 30, 1903, the cost of material was £13 18s. 11d.; area treated, 4,400 acres, *i.e.*, 2,200 acres twice. From July, 1903, to September 7th, 1904, the cost of material was £1 19s. 6d.; labour, £3 15s.; or a total of £5 14s. 6d, the area treated being 1,500 acres. The assistance of a boy is necessary, but the cost of labour shown above should be sufficient at ordinary rates of pay on farms, etc. During the first two years the cost of labour each year was about double that of last year. The great reduction in the cost of labour and material is, I consider, due to the systematic destruction of the burrows in the earlier period, and to the fact that after practice and careful observation of the effects of the application of the carbon bi-sulphide the operator has found it possible to obtain the desired result with a less quantity. Our practice has been to dig out all burrows of moderate size, and to fumigate the large burrows or warrens. The rabbits on adjacent lands do not appear to take kindly to our paddocks for a long time after a course of fumigation and burrow-destruction has been carried out. It has been necessary, therefore, to use the poison cart only once during the past fourteen months, although there are over 2,000 acres not netted.

The following is the method of applying the carbon bi-sulphide :—

Reduce as far as possible the number of entrances, including the "peep-holes," connected with the burrow to be operated on. For this purpose a few shovelfuls of earth will generally be found sufficient. Take a piece of cotton waste, forming a ball about 1½ inch in diameter, and saturate it quickly with the liquid, and throw it as far as possible into the open burrow. It should be promptly followed by a lighted wax match, which will rarely fail to cause an explosion, which will instantly fill the burrow with the poisonous fumes. All burrow openings should be promptly closed with earth. Although the fumes are probably quite as deadly without the application of fire, it is considered that they travel more rapidly after ignition and the smoke enables vents to be more easily detected. Great caution should be exercised in handling the liquid under all conditions, as it is highly volatile and explosive.

The drum containing the bulk supply should be buried at a safe distance from buildings, stacks, &c., and the necessary supply for the day should be carried in glass-stoppered bottles. No lighted pipe or fire of any description should be allowed near the material, and cool weather should be chosen for the work. The operator at the burrows should be the only person allowed to ignite the material when it has been placed in position, and the stopper should be replaced in the bottle before the match is lit. The treatment has always proved most effective, as we have never yet found a treated burrow to have been opened from the inside. Burrows opened up for test purposes within three minutes after treatment have disclosed numbers of dead rabbits, but never a living one, and rabbits taken from treated tree trunks in which there have beeen vents have expired within a few seconds. The price of the material is about 5d. to 6d. per lb. in Sydney, and 5d. in Melbourne. Our last purchase was 60 lb., which cost with freight, £1 12s. The cost of cotton waste was 7s. 6d., but some of the latter is still on hand.

The Grading and Cleaning of Wheat.

It has been said by those who have handled shipments of wheat from this State, that it competes at a disadvantage with the very frequently less high class but well graded and cleaned grain from the United States, Canada, and the Argentine. Dr. Cobb in his articles on elevators and seed wheat has described in this *Gazette* the trade systems in operation in many of the leading wheat-exporting countries, as well as going minutely into the question of grading the seed as it affects the farmer's crops and his pocket. In the *Gazette* of March, 1903, Dr. Cobb gave illustrations of several types of grading machines, after having had an opportunity of seeing in operation in all the leading grain-growing countries of the Northern Hemisphere between forty and fifty different makes of this class of machinery in operation.

The marketing of none but the best of his grain is a matter of great importance to the farmer whose holding is remote from the railway, and at great distance from the seaboard. If the grain is bagged up just as it comes from the winnower, as it very frequently is, it is seldom that it does not suffer in appearance on account of the inclusion of a considerable proportion of small, pinched grains and particles of rubbish. The low-grade stuff besides affecting the price, limits the market range unless someone cleans the grain, and then the chances are that the cost of that operation to the farmer in the shape of reduced price that must be paid to cover the expense of handling will be greater than if he did the cleaning either with a machine of his own, or with one owned in co-operation with his neighbours. Just as separating stations have been found to work very successfully in the dairy districts, co-operative grain-cleaning and grading depôts might be worked at convenient centres, perhaps at the railway stations or sidings, in the wheat districts.

Supplement to "Agricultural Gazette of N.S.W.," January 3, 1905.

HAWKESBURY AGRICULTURAL COLLEGE,
RICHMOND, NEW SOUTH WALES,

21 *December*, 1904.

IT is desired to obtain particulars as to - - - -

Birds causing Damage to Crops.

Sparrows, Starling, Silver Eye, Fruit Thrush, Jay,

Parrots, and other Native Species. - -

We would like you to assist in this matter by undertaking to record for your district any you may find or hear of doing damage to fruit or fruit-trees, garden, farm, or orchard plants; whether to buds, seeds, roots, or other parts.

It may be suggested that notes be taken at time of observation, giving details as to all circumstances, for transmission to us at end of the fruit season; such notes should contain the following particulars:—

Date—Place of Observation—Name of Bird—Name of Crop and part damaged—Amount of Damage—Comparative Scarcity or Plenty of the bird under review—Any other details the observer may deem desirable.

The stomach and crop may, with advantage, be examined for contents if shot or otherwise destroyed, or preserved in spirit and forwarded to us for that purpose at convenience.

Very valuable information on this subject would be forthcoming if a series of observations on these lines were made and committed to paper, which would be of immense use to an important industry.

It is hoped you may see your way to assisting in this matter. Should you decide to do so, it is recommended that all notes be entered on small sheets of paper, writing on one side only; a fresh sheet being used for each observation. A convenient size is 8 x 5 inches or 4 x 5 inches, or anything near that. These can be kept securely in a box, or tied up with twine.

All information shall be made use of, and duly credited to the observer when published.

H. W. POTTS,

FACTS, from personal observation, are desired concerning the ENGLISH SPARROW in this Country.

Will you kindly, at your earliest convenience, fill in the following Circular, and post same to the Principal, Hawkesbury Agricultural College, Richmond.

1. *Is the English Sparrow present in your vicinity; if not, what is the nearest point at which you know it to occur. If present, when did it first appear?*

2. *Is it abundant and on the increase?*

3. *How many broods and young does a single pair rear in a season?*

4. *Has it been observed to molest or drive off any native birds; if so, what species are molested or expelled from their former haunts?*

5. *Does it injure shade, fruit, or ornamental trees or vines? If so, give examples.*

6. *Does it injure garden, fruits, or vegetables? If so, give examples.*

7. *Does it injure grain crops? If so, give examples.*

8. *Has any case in which it has been of marked benefit to the farmer or horticulturist come under your notice; if so, in what way has the benefit been derived?*

9. *Under what circumstances does it feed on insects; what kind of injurious or beneficial insects or their larvæ does it destroy, and to what extent?*

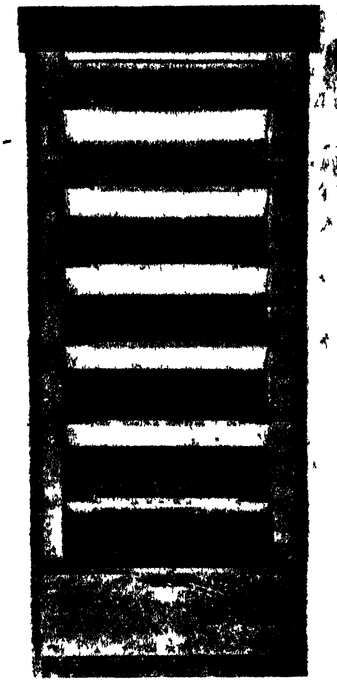
10. *What means, if any, have been taken to restrict its increase, and with what result?*

11. *Can you give statistics as to sparrows destroyed through special agency (bonus for eggs or heads, &c.) through any Society or Sparrow Club?*

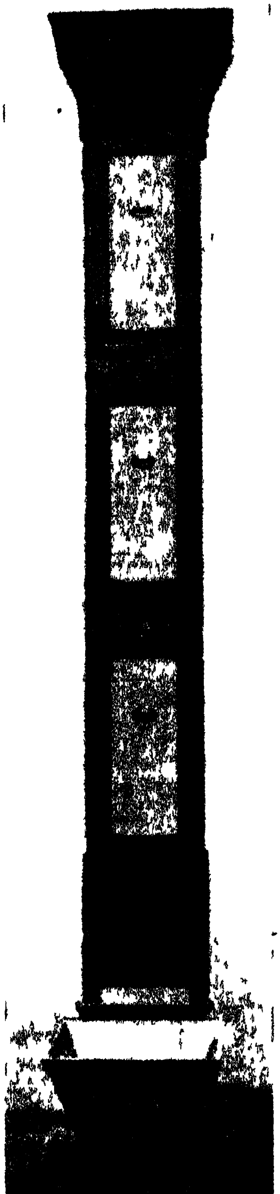
12. *What is the prevailing public sentiment in respect to the bird?*

13. *Have you any suggestions to make with respect to restricting the pest in the future?*

In several countries the farmers have banded together to secure for co-operative use machinery and appliances which improve the standard and reputation of their produce, and it would certainly pay the farmers in many districts of New South Wales to do the same.



Showing some of the Combs.



The Lightning Grain Grader.

Besides the grading machines already described and illustrated in the *Gazette* there is one recently invented in this State called the "Lightning Grain Grader," which is on a somewhat different principle, inasmuch as it is automatic, the grain being poured into a hopper at the top, and running by gravitation over a series of steel combs, that riddle out the rubbish which flows out of one opening while the cleaned grain pours straight into the bag. It is said that the machine which costs about £35 will dress 100 bags of grain a day. This grader will also treat barley for malting, oats, and weevily maize or grain of any kind.

Distillation of White Spirit from Potatoes.

Some attention having recently been drawn in one of the Victorian agricultural journals to this industry, in view of the rapid increase in the consumption of this article for fuel, motive, and other purposes, as shown in the great developments in that direction in America, Germany, and the European Continent generally, and inquiries having been received from farmers who are troubled with a surplus stock of potatoes, on account of the expense of carriage leaving them no profit for their labour and outlay, a few remarks as to the practicability or otherwise of growers finding relief in the spirit industry will be opportune; and as far as any immediate probability of farmers being able to thus utilise with profit their surplus "spuds," the prospect is not very alluring. The most that can be said is that—like many other industries of which this country is capable, and which the developments of time and the increase of population may bring in their train—at present the conditions do not appear favourable.

With regard to our production of potatoes, there is, of course, no such thing as a general surplus, as our produce merchants are well aware, and as any person who studies the figures of the Government Statistician may easily ascertain. The following statement shows the local production and the net importation for the past five years:—

Year.	Production. tons.	Net Imports. tons.
1899	61,900	58,384
1900	81,337	49,299
1901	63,253	42,627
1902	39,146	50,283
1903	30,732	62,083
Total for five years	276.368	262,676
Annual average	55,273	52,535

It will be seen that our average annual net import required to make up the deficient production during the past five years has been very nearly equal to our total production; in other words, we produce little more than half we consume.

It is, however, a fact that those farmers who are handicapped by long distance from market, and consequent heavy expense for freight, either lose or make little or nothing on their production, and have either to abandon the cultivation of this crop or seek for another outlet for its disposal, and to such the spirit industry has prompted inquiry. It was, however, palpable from the outset that the known stringency of legislation in connection with distilleries is sufficient to debar the farmers from undertaking it as a commercial enterprise; and any agriculturist laying out a shilling for the purchase of the Distillation Act of 1901, which may be obtained from the Customs Department or the Government Printer, will satisfy himself on the

point in a few minutes. In the first place, the annual license is £50, and security to the amount of £1,000 is also required; in the second, there is an excise duty of 13s. per proof gallon manufactured; and thirdly, it is abundantly clear, from the regulations, that the erection of plant is a very expensive matter. It would fill foolscaps to detail the requirements of the Act as to premises and plant, without going into the matter of supervision.

We have all heard of the burgomaster of the town who gave thirty-nine reasons for not firing a royal salute when the King entered the place, the last one being that they had no powder; and what has been written above may well appear a work of supererogation when followed by the simple statement that even if the farmer were allowed to distil white spirit from potatoes without let or hindrance, he would have to face the competition of the Colonial Sugar Refining Company, which, I am credibly informed, is producing *from a waste product* a white spirit so far superior to that obtainable from the potato that the imported German spirit (which pays only 1s. more than the excise duty) has now little sale on the Sydney market. I believe the Company could easily supply all Australasia.

The best advice to the growers who find they have a difficulty in disposing of their potatoes is to turn them into pork. It will involve less trouble and less capital, with a fair certainty of a profitable return.—W. H. P. Cherry.

Dairy Notes.

The rainfall in England during July was very much below the average. In fact, the summer there has been an exceptionally dry one. Half-an-inch of rain in forty-five days was the register of one of the fourteen stations that send a daily report to the Meteorological Office. This accounts for the short supply of home dairy products, and for the good demand and prices for all imported butter of good quality. "It is an ill wind that blows nobody good," and the dry winds of Europe will mean, probably, an extra penny per lb. to producers of Australian butter during the next few months.

In 1854 there were 1,517,672 milch cows in Ireland. In 1902 the number was 1,510,737, that being the largest number since 1877, but the numbers have shown very little variation in all those years, the lowest ebb being in 1864, when the number was registered at 1,348,886. In those early days of 1854, Ireland supplied England with almost all her butter, the imports from other sources being very small. Now the butter trade of England has become a matter of interest to almost every civilised nation, and England's butter bill, like her population, keeps growing regularly. Last year (1903) England imported £20,798,706 worth of butter, and the first six months of 1904 show an increase on the same period of 1903.—M. A. O'Callaghan.

Marram Grass for Drifting Sand.

I have frequently read in the *Agricultural Gazette*, and in the Sydney daily papers, articles on drifting sand, and statements of what has been done in various countries to restrain the destruction caused by the drift. I have on several occasions read of the value of Marram grass in preventing the sand from being blown to and fro by the wind. I now write to inform you of what I saw during a recent visit to Stanley, Tasmania. There is a sandy beach there, about half-a-mile long (Halfmoon Beach). Some forty years ago, when a schoolboy, there was a field, about 100 yards wide, behind the sand dunes. By the gradual encroachment of the sea, and the drift of the sand, the whole of the field was destroyed. When I left the district, twenty-five years ago, the sea had encroached by at least 50 yards along the whole length of the beach, and the remainder of the field had become a barren, sandy waste. Ten years ago the Van Dieman's Land Company procured Marram grass from the Warrnambool district (Victoria), and planted it in the sand. When visiting Stanley, in August last, I inspected the place, and was surprised to find the quantity of good feed between the Marram grass—clover, lucerne, and other good, succulent grasses; and also in some places fully 6 inches' depth of good soil, brought about by the decomposed vegetable matter, &c. Further, whilst in conversation with an old schoolfellow on the very spot, he pointed out a post, some 35 feet from the edge of the sandbank nearest the sea, and then went on to explain that nine years ago he had put it in at highwater-mark. This shows that the Marram grass is steadily recovering the land that has been filched by the sea. I am well acquainted with the sand-drifts near Wollongong, and feel convinced that similar good results could be obtained there by the use of the above-mentioned grass. The Van Dieman's Land Company is extending the planting of Marram to other sea frontages of their property in Tasmania.—W. T. Edwards, Thirlmere.

Keeping Lemon Juice.

In reply to a correspondent, who asks for information as to a means of keeping lemon juice, the Viticultural Expert reports:—The juice as it is squeezed out from the fruit is allowed to rest for 24 hours until a sediment collects at the bottom of the vessel. Then the clear liquid is decanted and reduced by heat to one-third of its volume, *i.e.*, three quarts of juice would be reduced to one quart. The heating process should not be done by direct fire, but by standing the vessel containing juice into a copper or some large vessel over the fire. On a large scale a water bath or steam circulating in a jacket boiler could be used. In any case, the vessel in which the juice is heated should be enamelled.

The juice may be sweetened by adding 4 to 5 lb. of sugar for every gallon of juice before it is reduced by heat. It is bottled when cool, but before bottling it may require straining or filtering.

To prevent deterioration by mould, the bottles, which are filled to an inch from the cork (which is tied down), are placed standing in a flat-bottomed boiler. Water is placed in the boiler up to an inch from the necks of the bottles, and then heated by direct fire up to 170 degrees Fah., and kept at that temperature for about 25 minutes. Then they are removed and laid on one side, *never standing*. To prevent heating of the bottles it would be well to have a false perforated bottom (of wooden battens) placed in the boiler.

The method of keeping fresh lemon juice, as used in the navies, is to add 10 per cent. of brandy; that is, one gallon of brandy to 9 of juice after it has been heated.

THE BUFFALO BURR.

MR. JAMES SLOANE, of Mulwala, in a letter to Mr. Maiden, states :—"I was pleased to see your plate of the Buffalo Burr in the last *Agricultural Gazette*. For the last year I have been much exercised about this plant, and have made unsuccessful attempts to find out what it was. When first reported here by the station employees I did not, from their description, realise its badness, but supposed it to be a milder weed with spiney seed-heads, and it had seeded before I examined it. When I saw your notice of the weed, though it was not described, I suspected it to be the evil thing that had appeared here. Fortunately, a boring insect took a fancy to the seeds and cleared out the contents of most of the heads. It came here in lucerne seed, and was first seen in a paddock that had been sown down the same season with Hunter River seed; but there is fairly clear proof that it was in the land before the Hunter River lucerne was sown, as it was in two patches. The paddock had four years before been sown with American lucerne seed.

"It is the most ferocious thing in the way of a small plant I have seen. Several useless weeds are getting a grip in this district, with more in the neighbourhood to follow. It is quite time something was done to protect the pastures. We have introduced several weeds in lucerne seed, but only one known to be noxious has remained—a catmint. I notice it is common in New South Wales. This came from Hungary. Another strange plant, also from Hungary, that may or may not be a weed, also came with lucerne seed. It seems quite unkillable, and grows thickly through the winter on cold, raw sand, and defies drought and rabbits. It dies above the ground in the summer. In the spring I will send you a specimen.

"Make any use you like of this note, and you may use my name and address. People cannot be given too much warning about such an infernal pest as the Buffalo Burr."

Crown Lands of New South Wales

THE following areas will be available for selection on and after the dates mentioned:—

H.S. or S.L. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
					For Homestead Selection.			
			a. r. p.		a. r. p.		£ s. d.	1905.
955	Cowra ..	Wattamadara	653 2 0	2	309 2 0 and 349 0 0	Koorawatha, 2; Wattamondara, 1; Cowra, 8	6 11 0 and 7 14 10	9 Feb.
954	Dubbo .	....	116 1 0	4	18 0 30 to 40 0 0	Murrumbidgerie, ¾ to 1½.	0 9 2 to 1 0 0	9 ,,
956	Nowra ..	....	20 0 0	1	20 0 0	Nowra, 7.	0 5 0	16 ,,
					For Settlement Lease			
775	Armidale ..	Balblair ..	3,260 0 0	2	1,500 0 0 and 1,760 0 0	Guyra, 8, Llangothlin, 2½; Armidale, 30.	18 15 0 and 22 0 0	23 F b.
774	Moree	Welbon	3,500 0 0	1	3,500 0 0	Moree, 37.	58 6 8	19 Jan.

For Improvement Lease.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
					Eastern Division.			
			a. r. p.		a. r. p.		£ s. d.	1905.
588	Bathurst .	. . . .	1,600 0 0	1	1,600 0 0	Perth, 11; Bathurst, 16.	13 6 8	Sale, 19 Jan.
583	Inverell ..	Strathbogie and Rocky Creek.	1,280 0 0	1	1,280 0 0	Emmaville, 9; Deepwater, 24.	9 6 8	Sale, 9 Jan.

For Conditional Purchase.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		a. r. p.			£ s. d.	1905.
Armidale	. . .	255 2 0	Skinner ..	Hardinge ..	1 0 0	16 Feb.
Bathurst ..	....	770 0 0	Crudine .	Roxburgh .	1 0 0	16 ,,
Bellingen ..	....	13,000 0 0	Moonee, Comlaroi, Coff, &c.	Fitzroy ..	1 0 0	23 ,,
Bingara ..	Ulumbarella .	128 0 0	Dunnee ..	Murchison ..	1 0 0	23 ,,
Boorowa	. . . .	80 0 0	Olney ..	King . ..	1 0 0	16 ,,
Casino ..	Rocky River ..	640 0 0	Sistova ..	Drake ..	1 0 0	2 ,,
Cooma	. ..	40 0 0	Bransby ..	Beresford ..	1 0 0	16 ,,
Cootamundra ..	Houlaghan's Creek	320 0 0	Sebastopol .	Clarendon ..	1 10 0	23 ,,
Dubbo	.. .	2,957 0 0	Willydah and Cowal	Narromine .	1 13 4	19 Jan.
Forbes	Trigalana ..	702 2 0	Marsden and Cadalgulee.	Gipps ..	1 0 0	16 Feb.
Grafton	. . . . .	300 0 0	Sherwood ..	Fitzroy ..	1 0 0	16 ,,
Gunnedah ..	Burrell or Gunnible	1,030 0 0	Gunnenbeme ..	Nandewar ..	0 7 6	2 ,,

FOR CONDITIONAL PURCHASE—*continued.*

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		a. r. p.			£ s. d.	1905.
Hay	Gunbar	8,000 0 0	Whealbah South ..	Nicholson ..	0 15 0	2 Feb.
"	....	717 2 0	Hay South	Waradgery ..	0 16 8	9 "
"	Eli Elmah	630 0 0	Tindale	" .	0 15 0	16 "
Inverell and Armidale.	Laura, Abbington, and Torryburn.	4,700 0 0	Laura, Barlow, and Torryburn.	Hardinge .	1 0 0	9 "
Kempsey .	....	3,500 0 0	Belbrook and Stuart	Dudley	1 0 0	26 Jan.
" ..	....	590 0 0	Unkya	Raleigh .	1 0 0	16 Feb.
" ..	. . . . .	120 0 0	Clybucca . ..	Dudley	1 0 0	16 "
" ..	. . ..	1,500 0 0	Warrell	Raleigh ..	1 0 0	23 "
Lithgow.. ..	. ...	3,075 0 0	Antonio	Westmoreland.	0 10 0	12 Jan.
Moruya .. .	.... . .	40 0 0	Urobodalla	Dampier ..	1 0 0	9 Feb.
Mudgee and Bathurst.	... . .	1,950 0 0	Tunnabidgee and Cunningham.	Wellington ..	1 6 8	16 "
Narrabri .	Millie & Burren	15,910 0 0	Coolga, Dewhurst, &c	Jamison	1 10 0	26 Jan.
" .	. . . .	100 0 0	Gurleigh . .	White	2 0 0	19 "
Port Macquarie..	. .. ...	356 3 0	Comboyne	Macquarie ..	1 5 0	2 Feb.
" .	. . ...	122 0 0	Redbank . .	" .	1 0 0	2 "
Tamworth ..	.. .	1,660 0 0	Attunga . ..	Inglis .	0 10 0	5 Jan.
" .	... .	1,730 0 0	Dinawirindi ..	Darling ..	1 10 0	9 Feb.
"	... .	16,750 0 0	Warrabah ..	"	0 10 0	12 Jan.
" .	. ...	750 0 0	Vernon ..	Parry ..	0 10 0	12 "
"	Wambramurra .	80 0 0	Crawney . .	"	1 0 0	16 Feb.
" ..	Phallaway, Walhallow, and Breeza.	496 3 0	Clift	Buckland	0 15 0	26 Jan.
Taree ..	....	40 0 0	Camden Haven . .	Macquarie ..	0 15 0	5 "
Tumut ..		50 0 0	Tumorrama . .	Buccleuch .	1 0 0	16 Feb.
Urana	Bundure .	610 0 0	Thurrowa . .	Urana	1 5 0	16 "
" .. .	Emu Plains	1,100 0 0	Lake and Morundah South.	" ..	1 10 0	9 "
Wagga Wagga .	Berry Jerry and Arajoel	860 0 0	Arajoel	Mitchell .	1 10 0	16 "
" .	Book Book.	194 2 0	Book Book ..	Wynyard ..	1 15 0	16 "
Wellington ..	..	150 0 0	Yarrobil	Bligh .	1 0 0	2 "

SPECIAL AREAS.

Bathurst Land District, 127¾ acres in two blocks, in parish Apsley, county Bathurst; maximum area, 86½ acres; minimum area, 41¼ acres; within village of Apsley, and distant 3 miles from Perth Railway Station; price, £1 10s. per acre. Available 1st December, 1904.

Boorowa Land District, in parish Rossi, county Monteagle, 57¼ acres in one portion; maximum and minimum area, 57¼ acres; distant 20 miles from Boorowa; price per acre, £1 10s. Available 5th January, 1905.

Grafton Land District, in parish Richmond, county Clarence, 612¾ acres in four blocks; maximum area, 155¼ acres; minimum area, 40 acres; price, £1 10s. to £2 per acre; distant 11 miles from Lawrence. Available 2nd February, 1905.

Murwillumbah Land District, in parish Brunswick, county Rous; 144¼ acres in one portion; maximum area, 144¼ acres; minimum area, 40 acres; distant ¼ mile from Tyagarah and 5¼ miles from Byron Bay; price, £2 per acre. Available 19th January, 1905.

Parramatta Land District, in parish Berowra, county Cumberland; portion 85 of 28 acres 1 rood 9 perches, portion 86 of 24 acres 3 roods 37 perches, and portion 90 of 26 acres 0 roods 15 perches; maximum area for portion 85, 28 acres 1 rood 9 perches; minimum, 24 acres 3 roods 37 perches; price, £1 10s. per acre; for portion 86, price £3 per acre; maximum and minimum area for portion 90, 26 acres 0 roods 15 perches; price, £2 10s. per acre; distant 16 miles from Parramatta, and 14 miles from Beecroft and Pennant Hills Railway Station. Available 29th December, 1904.

Further particulars with respect to these lands may be obtained on application to the Information Bureau, Lands Department, Sydney.

(Signed) JAMES ASHTON,
Secretary for Lands.

AGRICULTURAL SOCIETIES' SHOWS.

1905.

Society.	Secretary.	Date.
Dapto A. and H. Society	Geo. Lindsay	Jan. 11, 12
Albion Park A., H., and I. Association	Henry Tryer	" 18, 19
Kiama Agricultural Association	Jas. Somerville	" 25, 26
Berry Agricultural Association	A. J. Colley	Feb. 1, 2, 3
Moruya A. and P. Society	J. Jeffery	" 8, 9
Wollongong A. and H. Society	J. A. Beatson	" 9, 10, 11
Alstonville A. Society	F. H. Bartlett	" 14, 15
Ulladulla A. and H. Association	Jos. Kendall	" 15, 16
Lithgow A., H., and P. Society	H. N. Jolliffe	" 15, 16
Manning River A. and H. Association	S. Whitbread	" 16, 17
Southern New England (Uralla) P. and A. Association	R. Mackay	" 21, 22
Tumut A. and P. Association	E. H. Vyner	" 22, 23
Ulladulla P. and A. Association	Jas. Kendall	" 22, 23
Candelo A. and H. Association	C. H. Brooks	" 23, 24
Lismore A. and T. Society	T. M. Hewitt	Mar. 1, 2
Liverpool Plains (Tamworth) P., A., and H. Association	J. R. Wood	" 1, 2
Robertson A. and H. Society	R. J. Ferguson	" 2, 3
Port Macquarie and Hastings District A. and H. Society	J. Y. Butler	" 2, 3
Bombala Exhibition Society	W. G. Tweedie	" 7, 8
Tenterfield Intercolonial A. and M. Society	F. W. Hoskin	" 7, 8, 9
Fair Days	....	" 10, 11
Barraba P., A., and H. Association	J. W. Bull	" 8, 9, 10
Nepean District A., H., and I. Society	E. K. Waldron	" 9, 10
Oberon A., H., and P. Association	W. Minehan	" 9, 10
Berrima District Agricultural Show	Geo. Yeo	" 9, 10, 11
Gulgong A. and P. Association	C. E. Hilton	" 14, 15
Central New England (Glen Innes) P., A., and M. Society	Geo. A. Priest	" 14, 15, 16
Campbelltown A., H., and I. Society	A. R. Payten	" 14, 15, 16
Macleay A. and H. Association (Kempsey)	E. Weeks	" 15, 16, 17
Newcastle and District A., H., and P. Association	M. A. Fraser	" 16, 17, 18
Cumnock P., A., and H. Association	W. L. Ross	" 17
Blayney A. and P. Association	H. R. Woolley	" 21, 22
Gundagai P. and A. Association	A. Elworthy	" 21, 22
Warialda P. and A. Association	W. B. Geddes	" 22, 23
Mudgee Agricultural Society	J. M. Cox	" 21, 22, 23
Camden A., H., and I. Association	C. A. Thompson	" 22, 23, 24
Crookwell A., P., and H. Society	C. T. Clifton	" 23, 24
Wellington P., A., and H. Society	A. E. Rotton	" 28, 29, 30
Walcha P and A. Association	S. Hargrave	" 29, 30, 31
Hunter River A. and H. Association (West Maitland)	C. J. H. King	April 4, 5, 6, 7
Quirindi District P., A., and H. Association	Will. Cadell	" 5, 6
Clarence P. and A. Society	Jas. C. Wilcox	" 5, 6
Bathurst A., H., and P. Association	W. G. Thompson	" 5, 6, 7
Upper Manning A. and H. Association (Wingham)	W. Dimond	" 6, 7
Lower Clarence Agricultural Society (Maclean)	Geo. Davis	" 11, 12
Orange A. and P. Association	W. Tanner	" 12, 13, 14
Cooma P. and A. Association	C. J. Walmsley	" 12, 13
Richmond River (Casino) A., H., and P. Society	E. J. Robinson	" 12, 13
Royal Agricultural Society of New South Wales	F. Webster	" 19 to 27
Dungog A. and H. Association	Chas. E. Grant	May 3, 4
Moree P. and A. Society	S. L. Cohen	" 10, 11
Hawkesbury District (Richmond) A. Association	C. S. Guest	" 12, 13, 14
Walgett P. and A. Association	Thos. Clarke	" 17, 18
Molong P. and A. Association	C. J. V. Leatham	" 24

[3 plates and 1 map.]

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Agricultural Gazette of New South Wales.

The Myall Creek Estate—Available for Closer Settlement under the Provisions of the Closer Settlement Act of 1904.

THE purpose of the Secretary for Lands, Hon. James Ashton, in throwing open for closer settlement the areas comprised within the Myall Creek Estate is to enable persons to acquire under easy terms and definite tenure, culminating in freehold title at or before the expiration of thirty-eight years, holdings suitable for the practice of mixed farming on the intensive system, dairying and other forms of agriculture.

The notes and suggestions contained in this article have been made with the object of drawing the attention of settlers who may not have had the advantages of practical training in agriculture to some of the questions that will affect materially the prosperous development of a farm.

The scientific staff, experts, and field officers of the Department of Agriculture have for many years been engaged in the investigation of the various problems that affect the well-being of the agriculturist and of his crops and live stock. Experimental Farms have been placed in the different climatic regions of the State. At these all classes of crops have been grown, and a great variety of methods of cultivation and treatment employed to determine which are remunerative and suitable to the conditions of the respective districts.

All that settlers need do to be supplied with information as to the result of these investigations and experiments is to communicate with the Department of Agriculture, and their inquiries will be promptly answered. In cases where it is not practicable to convey the desired information by means of articles in the *Agricultural Gazette*, which is sent free monthly to all *bona fide* agriculturists, or by letter, arrangement can be made for one of the travelling experts to visit the holding and give a practical demonstration. Settlers are reminded also that the Agricultural College and Experimental Farms are open for inspection by those who desire to see any particular crops, methods, or experiments in progress. The most successful farmers in New South Wales, as in other countries, are those who look upon agriculture as a business concerning which there is always something to be learned, and who on that account are

ever on the alert for crops and systems of production that are more profitable than those they have been hitherto accustomed to. As the conditions of no two agricultural areas can be said to be precisely similar, the only way by which new crops can be introduced and different methods adopted with safety is for each farmer to undertake experiments on his own account, and, in the light of experience under his own peculiar conditions, cautiously feel his way to innovations. It is the aim of the Department of Agriculture to assist the agricultural community in this direction by the distribution of trial packets of seed and detailed information with respect to methods of culture. Those who take up areas under the Closer Settlement Act will have at their disposal the collective experience of the farmers of the whole State, and if they care to avail of this information from the outset, Myall Creek should become one of the most prosperous districts of New South Wales.

Description of Myall Creek Estate.

The Myall Creek Estate has for many years been utilised for pastoral purposes; a considerable area has been cropped with lucerne, wheat, and farm crops, while the remainder has been improved by means of ringbarking and clearing, conservation of water in wells and tanks, and fencing, of which there is 174 miles in all on the area. The country is lightly timbered with box, apple tree, ironbark, a little gum, and wattle undergrowth.

The land is undulating, and comprises deep rich chocolate or red soils of basaltic formation on the slopes, and rich black soil on the plains and flats, with some rocky and stony ridges of granitic formation.

Elevation.

The eastern portion of the estate is about 2,000 feet above sea level, and the southern portion about 1,250 feet above sea level.

Situation and Means of Access.

The railway line from Sydney to Inverell passes through the northern part of the area, and there is a frontage of about 17 miles to the railway. There are three railway stations—Gragin, Reedy Creek, and Mount Russell—either upon or immediately adjacent to Myall Creek Estate. The distance from Sydney is 477, 484, and 492 miles respectively.

The estate lies between the towns of Warialda, Bingara, and Inverell, the respective distances from these towns to the nearest part of the area being 10, 9, and 12 miles, by means of two metalled roads, which traverse the whole resumption. The furthest point of Myall Creek Estate from a railway platform is 12 miles.

The population of neighbouring towns is: Warialda, 600; Bingara, 880; and Inverell, 3,290.

Rainfall.

The average rainfall for twenty-three years is 31¼ inches, and the average monthly distribution is :—

January	3·66	July	1·80
February	3·72	August	1·71
March	2·78	September	2·27
April	1·99	October	2·60
May	2 15	November	1·88
June	2·22	December	3·04

This rainfall is amply sufficient for wheat growing. It falls at the right time to admit of ploughing operations, and in sufficient quantities during the growing period of the plant, and later when the grain begins to fill.

Water Supply.

Water for domestic use and stock is obtainable by sinking almost anywhere on the estate. There were at the time the property was purchased by the State 27 wells, ranging up to 100 feet in depth. Water was raised in one case by means of a steam pump of 4,000 gallons per hour capacity, and in other instances (10) by windmills. Owing to the contour of the country, the facilities for storage of water in inexpensively constructed dams and tanks are all that could be desired. There were at the time of purchase 31 dams in use.

The Myall Creek and its tributaries traverse the area, and contain permanent water for stock.

The cost of well-sinking for stock supply is stated to be £1 per foot. For domestic purposes, wells of small diameter and up to 30 feet in depth, could be dug by hired labour for about £3 to £4.

Temperature.

The average temperature for each month of the year, as recorded by the Government Astronomer, for the district comprising Inverell on the one hand, and Warialda on the other, is (*Inverell* representing the higher portion of Myall Estate; *Warialda* representing the lower portion) :—

	Degrees Fahr.	Degrees Fahr.		Degrees Fahr.	Degrees Fahr.
January	72 5	77·4	July	45 9	48·1
February	70·6	75·3	August...	48 2	52·2
March	66·8	71·3	September	53·9	57·7
April	60·1	64·1	October	60 8	64·4
May	52·9	55·9	November	66·7	70 8
June	46·9	49·8	December	70·7	74·6

Chemical Analysis of Soils.

Samples typical of all the classes of soils comprising the estate have been analysed by Mr. F. B. Guthrie, chemist to the Department of Agriculture, who reports :—

"These are all good soils chemically, being well supplied with plant-food, fairly rich in humus, and of good power for retaining moisture. In all these respects they compare very favourably with the class of

soils usually met with in the State, being above the average as far as regards content of plant-food, and being especially rich in lime, in which our soils are usually deficient.

"The soils may be classed as wheat lands, and should give good results with wheat, and will probably require less previous treatment for wheat than for most other crops. Besides wheat, other cereals, leguminous crops, and such fruit as are suitable to the climate of the district should be grown with success, if the stiffness of the soil can be improved. The soils have a tendency to alkalinity.

"The reddish-brown soil contains a considerable proportion of lime, and may be regarded almost as a calcareous soil. It is the most friable of those examined and should be easily cultivated; the others all require more or less treatment to improve the tilth."

Drainage.—From the fact that foot-rot and fluke are practically unknown on Myall Creek Estate, it is apparent that the natural drainage is sufficient for agricultural operations of all kinds. The freedom with which lucerne can be established, and the length of time (over 14 years) that it remains vigorous, also serves to indicate good natural drainage.

Vermin and Noxious Weeds.

Rabbits are to be found in small numbers in the granite ridges, but are not in any sense a pest, as they do not, in an elevated district like Myall Creek, spread as in the West. On some parts of the Estate Darling Pea is to be found. The patches can, however, be eradicated at very small cost even when special labour is employed, or the work can be done at odd times at no monetary outlay.

Average Crop Returns.

The average returns for Inverell district of wheat for grain are:—

	Bushels.		Bushels.
1895	15·7	1900	11·7
1896	9·6	1901	11·5
1897	18·5	1902	21·2
1898	15·4	1903	2·0*
1899	9·1	1904	15·1

Farmers in the vicinity of Myall Creek record averages of four to five bags (20 bushels), and in some cases six bags.

Lucerne is grown extensively in the district. The average return of hay per acre is four tons; but this yield does not represent the full capacity of the district.

Maize.—The average is 25 to 30 bushels per acre.

Potatoes, 6 to 8 tons.

Lucerne, 4 tons per annum.

Minor Crops.—See separate headings.

Clearing for Cultivation.

The greater proportion of the standing timber consists of white and yellow box, most of which has been rung, and is dead. This can be

* This season was the worst experienced in the State for over fifty years.

burnt out and all roots run below plough reach at a cost ranging from a few shillings to £1 5s. per acre. There is a small area of box, which, though ringbarked, has suckered, and would cost a little more perhaps to clear.

The rest of the timber comprises apple-tree (on the flats), iron-bark, and an odd gum here and there, with on some parts of the red-soil area a little wattle undergrowth. It is estimated by an experienced local farmer that the average cost of grubbing this estate, that is, removing all roots to a depth of one foot, and disposing of the trees, would be 27s. per acre. Clearing of this character would, however, be only necessary on certain small areas of a holding for fruit-trees and root crops. A considerable proportion of the plain country carries no timber at all, while among the well-rung portions there are great tracts that could be made ready for cropping at the expenditure of 4s. or 5s. per acre.

Cost of Ploughing.—The following figures are based on the actual experience of local farmers :—

Black Soil—First ploughing, 10s. per acre ; subsequent ploughings, 7s. 6d. per acre. Red Soil—First ploughing, 7s. 6d. per acre ; subsequent ploughings, 5s. 6d. per acre. Under the system of mixed farming—rotation of cereals, roots or rape with sheep and fallow—it is probable that the texture of both the black and red soils could be improved, and these soils in the more friable condition, which would be the natural outcome of systematic treatment, could be ploughed for 1s. 6d. per acre less.

Timber for Fencing, Sheds and General Farm Purposes.

There is a fair quantity of timber suitable for fencing on the Estate, and ample supplies may be obtained on Crown Lands and Forest Reserves in the immediate neighbourhood. The same applies to timber suitable for rough sheds, slabs, etc.

Timber for Building Purposes.

Sawn timber of all sizes and forms is obtainable in any quantity at Bingara, Warialda and Inverell, where there are mills. The timber generally used for building purposes is local pine, which is resistant to white ants. The cost delivered at Gragin, Reedy Creek, or Mount Russell railway stations is about 14s. per hundred superficial feet.

Notes on the Development of a Mixed Farm at Myall Creek.

At the inquiry into the purchase of the Myall Creek Estate the evidence of a large number of practical men of extended local experience was taken. All the data furnished pointed unmistakably to the fact that this estate provides throughout the greater proportion of the total area all the essential conditions for profitable pursuit of mixed farming. By mixed farming is meant thorough and systematic utilisation of an area of good land by cultivation of a wide range of

crops for market, fodder and domestic use, in conjunction with dairying; mutton sheep, pigs and fruit-growing, so that the settler may have the advantages of

(1) either disposing of his crops in bulk, or of converting them on the spot into milk, mutton, pork or other concentrated forms according to conditions of market;

(2) of getting substantial returns in the bad seasons as well as the good;

(3) of deriving at frequent intervals throughout the year cash returns from diversified sources;

(4) and of avoiding the risk of disasters to which the operations of single-cropping are exposed.

Crops.

Wheat.—Experience has shown that this crop is most suitable in every farming district of the tablelands and western slopes to be the pioneer, and it scarcely matters what particular section of mixed farming a settler at Myall Creek may either from inclination or force of circumstances ultimately make the leading feature of his operations, the chances are that he will see in wheat the best prospect of a return from the rough and ready methods he must perforce adopt in the developmental stages of his enterprise.

The best advice, based on the experience of men who have grappled with this important question and solved it successfully, is to pick the area, if at all practicable, where there are to be found the remains of the densest crop of thistles. Cropping in many newly-broken soils is precarious because of their sourness, and instead of the crops making vigorous, dark green growth, they will at a foot or so high sicken, turn yellow, and prematurely run to useless ear. Where the thistles abound, however, the chances are that the soil is quite sweet enough for wheat. The indication is not infallible—nothing in agriculture is, but for all practical purposes the choice will be found to be safe. Strong soils, such as the black and red basaltic formations at Myall Creek, are generally so well supplied with the elements of fertility that in wheat-cropping for the first few years, or until what is generally termed "the edge" is taken off them, there is considerable risk of rank, luxuriant growth of straw and flag at the expense of grain. Therefore, no good will be derived from the deep and elaborate preliminary preparation of the soil. Let that be a gradual process extending over three or four seasons, and attained by running the ploughs a trifle deeper at each successive working.

Method of Sowing Wheat and Quantity of Seed per Acre.

If a machine can be hired it will be found desirable in every way to drill in the wheat seed. By use of the machine every grain is sown evenly and at uniform depth; less seed by half need be used, *i.e.*, 30 lb. to 40 lb. instead of 60 lb. to 80 lb. per acre, as in broadcast; and the crop matures evenly.

Treatment of First Crop.

For the pioneer crop of wheat in imperfectly grubbed or cleared land, perhaps, by force of circumstances among rung timber, deep ploughing is neither practicable or warranted. If time will permit, the ploughing should be done sufficiently in advance of the sowing season (May), to allow of the soil to weather a bit before seeding.

When the crop is about 8 inches in height take the opportunity during a spell of dry days to put the harrows over it. The slight stirring of the soil does a lot of good in assisting to mellow it, and the effect of the loosely-broken surface is to retard evaporation if the weather remains dry, and to catch and hold rain if it should come. This is really the most critical stage of a wheat crop in virgin land. The next critical stage is met with when the crop that has done well enough shows indications of soft, rank luxuriance or premature heading in early spring. The remedy in either case is to put sheep on the crop. If a man owns no sheep, he can usually arrange to borrow a small flock which can be turned into the wheat paddock. Care should be taken, however, not to put the sheep straight in with empty stomachs. It is best to wait until they have had their morning feed of grass and have settled down; then when they get at the young wheat they will not engorge themselves.

The sheep must be watched and, if need be, worked over the whole area, though they will generally feed the stuff down evenly of their own accord. While the sheep are on this tender greenstuff, it is well to remember that they will crave occasionally for a bit of dry grass or something that will serve as a digestive. When sheep fairly bore their way from one well-grassed paddock to a place where the feed appears to be worse, it is done as a rule in search of a change of diet. At the Departmental Farms and at many of the most up-to-date mixed farms in this and other States, particularly in New Zealand, it is customary to place, in the green crop being fed down by sheep, a weather-proof box or trough containing a supply of straw chaff. The sheep find in this all the change of diet necessary to the proper digestion of their food, and give no trouble by breaking bounds. When it is a case of the pioneer crop, the best plan will be to turn the sheep out for an hour or so during the day. If they are left out all night and are not attended to until late next morning, the chances are that they will go in sufficiently full to be in a wandering, trampling, picksome mood, or they will camp in a mass on the bit of crop nearest the sliprails and waste time. Sheep must not be allowed on crops in black soil when it is wet or they will pug the land.

When the green is eaten off the wheat crop, the sheep must be taken off, or they will injure it.

The effect of feeding down in this way is to stimulate stooling and a healthy growth that is capable of carrying to maturity a heavy crop of grain. At Bathurst Experimental Farm, during 1904, the wheat which had been fed down by sheep returned 24 bushels per acre, while crops all round the district grown without sheep, but under the same conditions of rainfall (16½ inches) and soil, did not yield 5 bushels per acre.

To a very great extent the conditions of Myall Creek, from a cereal-growing point of view, are akin to those of New Zealand, and there the practice of working sheep in conjunction with wheat-growing is almost generally adopted.

When it comes to harvesting the crop on imperfectly cleared land, it is generally a case of the stripper nilly-willy, although the way wheats "lie" in this district makes the use of the stripper very wasteful.

If a farmer is sufficiently skilled as a ploughman to turn under successfully with a drag-chain on the beam of the plough the wheat straw as it stands after the passage of the stripper, there is every reason to believe that the incorporation of such a mass of decaying vegetable matter would improve the texture of the soil very much indeed. And the more that can be done, the easier will be the subsequent ploughing and working. In the case of the black soils, which cost 7s. 6d. per acre for second and subsequent ploughings, the addition of the straw, if it can be got under, would tend to lighten the character of soil; it would become less slimy and sticky when wet and less inclined to parch out in dry weather. If, however, a man does not feel competent to perform this work, the only course will be to turn the sheep or stock on to the stripped paddock to eat up odd ears of grain and trample the straw down so that it is sufficiently broken up to turn under. Another plan, and a pretty good one, would be to put set harrows over the stripped crop. The effect would be to comb it out in the direction of the next ploughing. Where the cropped land has been sufficiently well cleared to allow of the safe passage of the reaper and binder, that mode of harvesting will be the best. Certainly it involves considerably more labour in stooking the sheaves, carting and stacking, with subsequent threshing. The remains, in the shape of straw, may appear to be a drug on the farm from which it is not possible to market inexpensively such a bulky material, but it will be found on a mixed farm that there are endless uses for straw to supply bulk in winter for more concentrated foods like grain, and there is always the chance of a farmer who thatches his straw-stacks well to find in seasons of scarcity in other districts buyers for his straw at remunerative rates. At Wagga Farm, the surplus straw accumulated for three years. Then came a demand for it, and the 400 tons were chaffed and sold for £1,300, of which £935 was nett.

Before the wheat grain is harvested and while the berry is still in the dough stage, *i.e.*, before it has become firm or hardened, sufficient of the outskirts of the crop may be cut for hay for farm use.

This matter of harvesting for hay at the right stage is of considerable importance, as crops are often allowed to become quite useless for hay under the mistaken impression that it will be improved by allowing the grain to ripen.

Imperfect preparation of Land.

It should be borne in mind that the foregoing suggestions as to shallow ploughing and makeshift methods are intended to apply only to pioneering stages of farming at Myall Creek. As time goes on, it

is hoped that every settler will, in the interests of his pocket, be able to see his way to do everything thoroughly and well. But when a man first comes into possession of a holding, he finds such heavy demands on his capital, and so many jobs to do before the advent of the season he must catch for a first return, that it is generally unwise to attempt to prepare at great expense areas that may, after all, not be ready for planting at the right stage of season, and which, on that account, may fail to repay the outlay. It is far safer in the case of a pioneer crop to confine the risk to the lowest limit than to attempt a big coup, and perhaps break one's financial back at the outset.

Class of Wheat, and varieties best adapted for Myall Creek.

Wheats, of which some 700 more or less distinct varieties, or rather names of varieties, have come under the notice of the Department of Agriculture during experiments to determine their correct identity, can be roughly divided into a few groups, and of these, the Fifes or Manitoba, Bobs, Marshall's No. 3, Zealand, White Hogan, and John Brown, might be recommended as good and reliable croppers for the wheat lands of Myall Creek. For the heavy rich soils wheats of the meanest, scantiest habit of growth are essential. Free-growing kinds, like those of the Purple straw group, would have a greater tendency to run to straw at the expense of grain than the other types mentioned, and should be rigidly avoided for Myall Creek, though it must not be forgotten that in rich soils the first crop of wheat is subject to many vagaries, and even the safest of varieties on worn land may behave peculiarly as a pioneer crop. At the Glen Innes Experimental Farm the hard wheats—Fifes, Manitoba, and fairly hard wheats, Bobs, Marshall's No. 3, and Nutcut—have been tried in strong, heavy land, and have done well, and resisted rust.

Mr. C. L. Smith, of Inverell, in 1903, had 325 acres under Manitoba variety. His return was 24 bushels to the acre of plump grain, weighing 63 lb. to the bushel, of excellent colour. This sample was regarded by wheat salesmen as one of the best that has so far been produced in the State. Farmers in the immediate vicinity of Inverell who used ordinary seed found that, through rust and bleaching, their crops returned not only a much lower average, but the weight per bushel was very much less, and consequently their profit was proportionately reduced. The wheat expert of the New Zealand L. & M. Agency, Sydney, who handled Mr. Smith's wheat, reports that while the market for prime milling wheat was standing at 2s. 11d. to 3s., they effected a sale of this Inverell Manitoba at 3s. 9d. per bushel.

The difference will be better understood by the following figures:

One acre Manitoba yielded 24 bushels @ 3s. 9d., equal to 90s. per acre.

One acre Purple straw yielded 15 bushels @ 3s., equal to 45s. per acre.

Since it is simply a question of adaptability to district, it is fair to assume that the cost of producing both varieties would be the same.

In the selection and identification of varieties for seed, settlers are advised to utilise the services of the experts of the Department of Agriculture. Advice will at all times be promptly furnished with trial packets of seed true to name.

The importance of fallowed land in Inverell district.

One of the most important factors in the safe production of wheat in these soils will be the practice, which is adopted by all good and prosperous farmers in the tableland districts, of breaking up the stubble land as soon after harvest as the team can be spared. This ploughing can be as rough as one likes. The object is to give the atmospheric conditions a chance to operate beneficially on the soil mass and mellow it, as well as to have the area in condition to catch and hold whatever rains may fall between January and April, so that the subsoil will be well moistened and the top soil rendered more friable. Work, such as this, may involve an extra expenditure of 5s. per acre on wheat land, but the prospects of increased yield are so generally fulfilled in the actual experience of all who fallow such land, that it is a profitable investment. In course of time, say beginning with the third season, when more land shall have been prepared for cultivation, it will be found expedient by those who are able to have a small flock of sheep, to put the old wheat area under rape in February. This crop will provide abundance of splendid feed for the *sheep and lambs, and the soil enriched by their droppings and the remains of the rape turned under will be in first-class condition to produce a heavy crop of maize sown in spring. After the maize is harvested, wheat can be again sown, so that in three years the farmer who adopts fallow and rotation of crops will get a crop of wheat, a crop of rape, and the returns from fat sheep or lambs, a crop of maize and a crop of wheat. This is an example of what generally goes under the, to some people, terrifying name of "Scientific Farming." As a matter of fact, scientific farming is intensive use of the land, which is never allowed to be idle without definite object, and turning to profitable account every blade of stuff that appears above ground. For the successful practice of this system, sheep are almost indispensable. They act as scavengers on the cultivated lands, eating up the black oats and nearly all the weeds that would otherwise foul the area and rob the crops of plant food and moisture.

Maize.—On the heavy dark land and the lighter red soils of Myall Creek, maize will do well. The experience of the farmers of the district is that nearly all of the three main types of maize—flint, dent, and white of both types—will average about 30 bushels per acre. There is every reason to believe, however, from the soil indications and the general conditions of rainfall, that even heavier returns than 30 bushels can be obtained when the land is specially prepared for maize in rotation. For instance, while a fair return may be obtained from land put straight from virgin condition under maize and cropped with that plant repeatedly for a succession of seasons, it is

* Pregnant ewes should not be put on rape.

possible, by occasional green cropping of the area between the harvesting of one maize crop and the sowing of the next, that is, during autumn and winter, to get rid of weeds, to improve the tilth of the soil by the extra workings, to add to the fertility by the droppings of the animals used to feed off the greenstuff, and pay for it all with the resultant fat stock or milk. In maize-growing, frosts are an important consideration. So far as it is possible to ascertain from meteorological records at the State Observatory and from the experience of local residents, frosts can be normally expected from May to September, and on that account would not constitute a menace to maize culture. It is just as well to remember, however, that on open plains there is always a risk from frosts earlier and later than is the case on the hillsides. In case of abnormal occurrence of frost, such for instance as one on the 28th January, as experienced on the flat at Bathurst in 1904, the man who has stock, especially dairy cows, need never be at a loss. The frosted crop can be cut and converted while still green into ensilage. Later on will be found full details of simple and inexpensive methods of conservation of fodder.

Here it might be mentioned that, for grain for market, yellow varieties are to be preferred, not because they are more prolific or possess greater feeding quality, but because there is a prejudice that operates against white maize to the extent of a penny a bushel. For green fodder and for ensilage for dairy cattle, white varieties or any of the big yellow kinds of luxuriant habit can be used. In the successful production of maize much depends upon the amount of cultivation and attention the crop can receive from the time it shows above ground until the cobs are filled. The best returns are received from the crops that are never allowed to languish through the excessive drain upon soil-moisture by weeds, or evaporation from a set surface. To facilitate cultivation, the crops should be set out in rows 4 feet apart with a grain at every 12 inches or so; this can be done by means of a maize drill or planter; or the crop can be planted by hand in checks, that is, three or four grains are dropped at the intersection of lines 4 feet apart each way. The reason for allowing such a space as 4 feet is to enable the eradication of weeds and the stirring of the surface to be performed by horse implements, which are inexpensive and effectual. At first, the implements can be run fairly deep; but as growth advances, the depth of cultivation must be decreased until the tines merely skim the surface and crack the crust. This is because the roots spread through the upper layers of soil as cobbing approaches, and if these roots are destroyed the yield will be affected.

Where the crop is intended for green fodder or ensilage, it will pay to take the same care as for grain, but the seeds can be placed near each other in the drills, and the drills need not be more than 3 feet apart. Where the land is kept well scarified, there appears to be no particular advantage in hilling the maize crops.

Some farmers practise broadcast sowing of maize for green fodder and ensilage, but this is not advisable unless the land is pretty clean. If there are many weeds, use of the harrow in the fallow before seeding will destroy a good many; but it happens sometimes that weed

seeds may not germinate until the crop is sown, and then the young maize has to fight for existence while the farmer can do nothing to destroy the weeds.

Barley.—This is a crop that it will be well worth the while of holders of areas of the red soil to pay attention to. Barley, of all cereal crops, is the daintiest feeder; but where it finds in well-drained, well-worked soil, congenial conditions, it is a very heavy yielder of grain for which, for malting purposes, there is big demand in this State at a price generally over 3s. per bushel. The main difficulty in the production of malting barley is in the threshing, which must be done with more than ordinary care, and in such a way that just enough of the awn is left to suit the requirements of the maltster, who cannot get good results from either a grain chopped into the germ or one that lies too densely for circulation of air. For dairy purposes barley is an admirable crop. It is not the sort of crop that can be relied upon to succeed in virgin land, but in the older, sweet soils, heavy crops of grain can be secured after the area has been fed down with sheep, or the crop has been mown and carted to the cowsheds; or it can be sown from early January till about the end of June, at intervals, to provide green feed in succession for dairy cattle in winter. Sown in late summer or early autumn with tares, field peas or vetches, in the proportion of 1, ½, ½ bushel, barley forms the basis of a complete ration for dairy cattle, and such a combination can be utilised either green or as silage. Barley grain is extremely valuable on a mixed farm where pigs have a place among the stock. For the production of the most profitable class of bacon, with bright red lean and hard white fat, barley is indispensable. For grain, the ordinary English malting and Chevalier varieties can be recommended for the red lands of Myall Creek. For feed and ensilage (see page 21) the skinless barley is always worthy of a trial. Cape barley will certainly produce as luscious a green feed and possibly as abundant a crop, but if the bearded barleys for any reason are not all used up before the beards harden, they are objectionable to use for fodder, and are not much good for anything else, except poultry feed.

Rye.—Rye will grow well enough on the drier slopes of Myall Creek, and is worth some attention as a crop which will generally thrive under conditions too severe for either wheat or oats. It is not, however, entitled to so much consideration when crops not so likely to cause trouble to cattle can be grown. The straw is tough and wiry, useful, and at times saleable to saddlers at about £5 a ton for collar making, but its chief use is for thatching, the great length and toughness of the straw rendering it suitable for the purpose. Mammoth and Emerald are two varieties which would probably succeed at Myall Creek, although the White Italian would be a likely variety.

Lucerne.—This crop has been grown for many years on several parts of the Myall Creek Estate for hay-making and grazing. All the black soil and much of the undulating red basaltic soil of the area is admirably adapted for it, and there is scarcely a farm in the Inverell district where lucerne has not found a footing. From the evidence of experienced local farmers and graziers, under ordinary conditions of

more or less rough-and-ready preparation of the land, generally by means of a crop or two of wheat, and without deep ploughing, the crop will yield about three to four cuts a year, and the average amount of hay made is about 1 ton per acre a cut; in grazing, Mr. Ford, overseer of Myall Creek, stated that he had run sheep at the rate of twenty-seven per acre for a week at a time. The uses to which lucerne as a green forage or as hay or ensilage can be put are so numerous that no time should be lost in preparing for an area.

The site chosen for lucerne should always comprise the best soil on a farm, and since the plantation is likely to last for a decade at least, no pains should be spared in preparing the area in such a way that the crop, which in its early stages is inclined to be delicate, may become firmly established in a seed-bed free from weeds and deep enough to permit of the roots striking to a depth beyond the reach of drought.

In some places. lucerne may succeed fairly well as the first crop in virgin soil; but, generally speaking, it is found to be advisable to sweeten the land by means of a couple of cereal crops, or, to save a year, the area might be deeply ploughed in autumn and left exposed to the influence of frost and weather until spring, when lucerne could be sown. Spring-sown lucerne, however, has not the same chance of successful establishment as that sown in autumn, and which, during the cool months, can develop a widespread and deep root-system to help it over its first summer. On a dairy farm, the best plan would be to put the area intended for lucerne under wheat or oats, which could be cut for green feed. In spring the land could be ploughed again and sown to maize in drills, or potatoes—the cultivation required for either of which crops would tend to pulverise and thoroughly sweeten the soil. If the subsoil is not very friable, to facilitate the downward growth of the lucerne roots, when the third ploughing is in progress a plough with the mouldboard removed might be used in the same furrow to loosen, but not bring to the surface, the layer of soil 4 or 5 inches below the depth of the surface-ploughing of 6 to 8 inches. After this work is performed, by (say) March, the harrow should be used on the area as often as time can be spared to destroy any weeds that show up and to improve the tilth, so that when, after the first soaking shower in April, 12 lb. of lucerne seed is evenly sown and very lightly covered, the tender young plants will be able to thrive apace. Any check during the first stages of growth in a lucerne paddock will affect the returns for years. During winter not much growth may be noticeable, but if a young plant growing in soil treated as indicated is pulled up it will be found to have a mass of roots over a foot in length. As soon as the weather begins to grow warm, rapid growth will take place. The growth of weeds among the young lucerne in spring will govern the date of the first cut. If the time be well chosen, it will be possible at this stage to destroy, in the mowing, weeds before they get a chance to seed. The mixture of lucerne and weeds can be converted into first-class silage, and generally this is the most profitable use to which it can be put, as in a normal spring there is such abundance of succulent feed on the lightly stocked natural pasturage about a new farm that there is no

immediate use for green lucerne, and the admixture of weeds would render the first cut undesirable for hay. Subsequent cuts can be utilised for green feed, or when that is not required, conserved as hay or ensilage for use in the times when such foods will be most welcome. The right time to mow for hay is when the bloom begins to open. A young lucerne crop should not be allowed to exhaust itself by seeding. If a crop of seed is required, a portion of the area should be set aside in December and harvested for seed; but unless a farmer goes in for growing seed as a speciality and has all the necessary appliances, it is always cheaper to buy lucerne seed. It should have a waxy appearance. If there is any doubt about a sample, it may be submitted to the Department of Agriculture for germination test free of cost.

If the soil, especially the black land at Myall Creek, is well and deeply prepared, it will become retentive of moisture and not parch and gape in wide cracks. As time goes on, however, and especially if occasionally stock are depastured on the lucerne, the surface of any class of soil will become hard, and liable to throw off rain and crack. To correct this condition, opportunity should be taken after rain to run the harrow, preferably a disc harrow, over the cut crop to loosen the surface of the soil. The stimulating effect of this treatment is remarkable. Pigs depastured on lucerne will do very little harm to the crop, and dairy cattle will not eat it too closely; but sheep, if allowed to remain on too long, will begin to gnaw into the crown of the plants and destroy them. No animals should be turned on to a luscious crop of lucerne while hungry or after hard driving, as "bloat" or "hoven" may ensue. When a horse, cow, or working bullock by any chance breaks into a lucerne paddock and suffers from bloat, a simple treatment is to make the beast stand with its fore feet on a fairly high bank. To stand them with their hind legs in a waterhole is a good plan. If the case is serious a rubber tube thrust down the throat and into the paunch is one way, and an incision in the flank another method of allowing the gases to escape. In the case of sheep, the incision is the only practicable treatment.

In the case of black soil stock of all kinds must be kept off lucerne in wet weather.

Potatoes.—This crop is nearly always a safe pioneer, and it is a good plan to put the small crop required for domestic use on some little patch that can be afterwards used for vegetables or crops that require clean land. The best results in potato growing are obtained by the use of medium-sized, healthy tubers that will stick together when severed with a knife, and are nice and white throughout the flesh. On a new farm every precaution should be taken to avoid contamination of the ground by means of unhealthy seed. Indeed, it is a safe plan when one receives the three or four bags of seed ordered for planting an acre, to empty the sacks on to a sheet well away from the area to be planted, hand-pick and reject any that show the encrustations of scab, the little knobs of wire-worm, or the rottenness of wet rot, and burn them with the sacks. For the sake of a few sacks that are worth perhaps a shilling, any one of the diseases

mentioned, and perhaps potato moth as well, may be introduced to a new area and reduce the yields by half. Before sowing the seed, treat it with corrosive sublimate—2 oz. to 16 gallons of water in a wooden or earthenware vessel. The chemical will cost a couple of shillings, but the expenditure will be recouped a hundredfold.

Linseed.—As a material of value in the feeding of calves, and for all classes of farm stock, linseed is worthy of a place on every farm. At Myall Creek, particularly in the higher land, the flax may be sown in August in any well-prepared patch, and the crop, ripe in about eighteen weeks, can be sheaved if necessary and threshed with an old-fashioned flail. An acre sown at the rate of ½-bushel seed should, by lateral branching, return 40 to 60 bushels of linseed. The crop is ready for harvest when the plants turn yellow.

Fruit and Vine Culture.—The undulating red soil areas of Myall Creek are admirably adapted for all kinds of fruit-trees and vines. Among the fruits which have been successfully grown in the district are apples, pears, plums, apricots, cherries, peaches, nectarines, in certain parts citrus fruits, table, wine, and raisin and currant vines, with strawberries, raspberries, and gooseberries.

Taking market conditions and all other circumstances into consideration, it would not appear to be advisable for a man of limited means and immediate necessities to take up an area of this land with the intention of being entirely dependent upon fruit-growing for a livelihood. There are exceptionally good opportunities, however, for farmers to in the first place establish a small orchard of mixed fruits for domestic use—table, jam-making, preserving, &c. Then, as opportunity occurs, the plantation might be extended to embrace as much as 5 or 10 acres of apples, pears, or cherries, of varieties that either come on very early or very late, and which carry well.

The Sydney market is capable of absorbing an enormous quantity of apples and pears, and there are generally good openings for such fruit inland and on the coast, where they do not grow well. Every year the importations of apples from Tasmania and California amount in value to about £250,000, and there is no reason why growers in districts of the elevation of Myall Creek should not be able to successfully compete in the trade.

The main point will be to secure the varieties of most commercial worth. The Fruit Expert to the Department of Agriculture would recommend for the district:—

Early Apples.—Gravenstein and Carrington, both of a very marketable class at a time when there are no Tasmanian and exceedingly few American apples available.

Late Apples.—Munroe's Favourite, Granny Smith, Stone Pippin, Yates, and possibly, on the heavier land, the Sturmer Pippin and New York Pippin—two Tasmanian apples of great value, as they will keep till the end of the season when apples are scarce and dear.

The only kinds of pears to be thought of, except for domestic use, are the late, long-keeping, good carrying varieties such as Packham's

Triumph, Winter Nelis, Pat Bary, and Bon Chrêtien. Of cherries, the best carriers as well as the most productive varieties are the Florence (white), Reverchon (black), and Early Lyons (red). Other varieties can be grown to perfection, and many can be sold in Moree and Warialda; but for the more distant markets the varieties mentioned would be found to be most profitable. There are several late, firm-fleshed peaches which might be advantageously marketed from Myall Creek, but it is very questionable whether they would prove remunerative. The Shanghai Cling, Late Crawford, and Royal George are suitable kinds. Almost any variety of apricots will do well. This fruit is not as a rule a good carrier, and, generally speaking, the big markets are over-supplied. At Inverell, grapes for table, wine, and raisins and currants have been successfully grown for many years. There would no doubt be a considerable demand for this fruit at Moree and Warialda, but unless there happened to be an extraordinary dearth of table grapes from the Hunter and the counties of Cumberland and Camden, it would not pay to attempt to dispose of this bad carrying fruit in the metropolitan market. The Hermitage, Malbec, and Verdot varieties for red wine, and Reisling, Shiraz, Verdeilho, and White Sherry for white wine, are said to do well in the neighbourhood of Inverell, while the Muscat of Alexandria and Canon Hall Muscat for drying also do well. Where an orchard or vineyard is established as a subsidiary aid to mixed farming, it can with a little management be cultivated and worked at trifling expense by means of horse labour. The ploughing in winter can be done at a time when the teams may be otherwise idle, and the summer cultivation is never a serious matter if the work be systematically done. To facilitate operations and ensure economy, care should be taken to lay out the place in such a way that all trees will be equidistant apart each way in perfectly straight lines, so that there will be no corners inaccessible to horse implements. If the ground be well prepared by ploughing and subsoiling by means of a plough without a mouldboard running in the furrow behind an ordinary plough, sturdy yearlings be planted and systematically pruned from the outset, the orchard will be not only a source of profit, but become an attractive feature of the landscape. No artificial drainage is likely to be necessary on the slopes chosen for orchards. The soil is quite rich enough to maintain the trees without the aid of artificial manures until at least the bearing stage, but the work of tillage can be considerably reduced and the moisture-retaining properties of the soil increased by the occasional sowing and turning under at the flower stage of a crop of field peas or tares.

If the only available slope with the proper aspect—north-east or north—is steep, care should be taken to cut a drain to prevent storm waters from the higher lands rushing across the plantation. Much time and labour is involved in repairing washaways in an orchard.

Sheep.—Reference has already been made to the part that sheep can be made to play in the successful management of a mixed farm.

Here it might be mentioned that, unless a farmer is prepared to keep his ploughshare polished, sheep on a small holding will not be a

success. It is not so much from the profits arising directly from the sale of the products of the small flock as from the extra working of the land, and the maintenance of its fertility by beneficial crops that their upkeep entails, that the farmer derives tangible benefit. Farming and grazing is one thing, and farming with sheep is another line altogether. The first system is eminently suitable for the semi-arid districts, where sheep can be used for the renovation and spelling of wheat lands on holdings so extensive in area that hundreds of acres can be alternately tilled. Farming with sheep is an industry solely adapted for districts like Inverell, where a man's operations are of necessity confined to a small area, and natural conditions permit of intensive cultivation. To successfully pull through the risks to which single cropping and little or no artificial fodder expose him, the farmer and grazier must needs be a man of capital, or settle in a district where land is more plentiful than rain. On the other hand, the man who farms with sheep can do with so much less land that, even if his capital be very limited, he can settle in a district where the soil is rich, the rainfall is ample, and the climate is genial. On a systematically-managed mixed farm, the food for the little flock of ewes and their lambs seems to come along in natural progression. The sheep are part of the rotation, and as soon as they have converted a crop into mutton, or wool, or fat lamb, the ground is literally ploughed from under their feet, and they have a turn on the little bit of grass land, or go straight on to another area which, perhaps, if it were not carrying a catch crop of something to feed them, would be expending its fertility on the production of weed seeds to blow all over the farm.

In a district like Myall Creek, there is scarcely a month in the year that something nutritious cannot be sown for sheep. In January, swedes, turnips, rape, barley, and rye can be sown on a small scale; in February, rape, kale, swedes, turnips, barley, rye, and wheat; in March, rape, mustard, kale, barley, oats, rye, turnips, field peas, tares; in April, wheat, oats, barley, rye, lucerne, rape, field peas, tares, grasses and clovers, sheeps' burnet (on any bare little patches in the poorest parts of the grass paddock); in May, wheat, oats, barley, rye, lucerne; in June, barley and rye; in July, oats, peas and tares; in August, oats; in September, sorghum, mangolds, sugar beets, maize; in October, cowpeas, maize, sorghum, millet, and pumpkins; in November, the same; and in December, towards the end of the month, rape and swedes, with maize and sorghum, can be sown if desired.

Merino sheep are of little use as a small farm flock. A strain of the Merino, however, is good in the ewes. Lincoln-Merino ewes with Shropshire rams, pure Shropshires, or Suffolk-Down with cross-bred ewes, appear to be the most easily managed and profitable. Farm sheep want a bit of hard, well-drained ground to camp on, a shelter from bleak weather, and a bite of dry tack with their succulent forage.

Pigs.—If one were to search the length and breadth of the State it would be hard to find a district more favourable than Myall Creek for pig-raising for bacon. There are all the essential factors of the industry.

The facilities for dairying are such that it cannot be long before a large number of settlers are attracted, and with the expansion of dairying there will be available skim milk for pigs. In Great Britain there is an enormous demand for bacon and hams, £5,000,000 worth being, on the average, imported every year. The pig-farmers in the great maize belts of the United States have striven in vain for the cream of that trade; Canada has left no stone unturned to secure it, but without avail. The reason why the American farmers cannot turn out the very primest quality of bacon is because, for a great many months of their long winter, the pigs have to be stall-fed. This, in conjunction with the excessive use of maize, induces a softness of the fat that is not desirable. For use with the bye-products of dairying, all classes of pig fodder can be grown at Myall Creek, and in the temperate climate stall-feeding in winter will be unnecessary.

In evidence, during the inquiry into Myall Creek resumption, Mr. W. G. Ford, a native of the Hunter River district, and a practical farmer of twenty-nine years' experience, and farming overseer on Myall Creek Estate since 1897, said:—"I look after the pigs. They run in the lucerne paddock. I have 160 to 170 pigs; they run on 40 acres of lucerne and 70 acres of bush land. They do remarkably well feeding on the lucerne. They fatten so well that buyers come and buy them, and I think they send them to market. They buy, and I sell them as fat pigs. They come with waggons and take them away."

At Myall Creek, lucerne grows well on all the black soil and on much of the red land. This, to the pig-raiser, is a matter of importance, since lucerne will provide an enormous proportion of the cheapest and best food pigs can have. With snug shelter from the sun, rain, and wind, the sows and their litters can live in the lucerne paddocks and will require nothing more than a few cobs of maize or handfuls of wheat per day until the youngsters are weaned and ready to undergo the process of topping off for the curer.

For this purpose, the ration may consist of skim milk, barley, a little maize, peas, pumpkins, broom millet seed, Kaffir corn, or any other grain or pulse that it is found advisable to market in the concentrated form of pork. To prevent disproportion of fat and lean, the animals can be depastured in small paddocks of lucerne. Fencing for pigs need not be elaborate, three barbed wires on an ordinary wire fence, with the lowest wire placed about 1½ inch from the ground will be all that is necessary to restrain them. The secret of profitable farming is to have no waste, and the pig is the best possible medium through which to realise on any odds and ends of produce. Where sheep are not kept on a farm, pigs can be turned on to the wheat and barley stubble to glean the waste grain.

On some of the areas it will be found to be worth while to give to pig-raising the first place in the operations of the holding. When that is done, the most profitable course is to grow in rotation a variety of crops into which the pigs can be turned to forage for themselves. In such a rotation lucerne will be always the mainstay and standby.

The following crops could be grown throughout the four seasons for pig fodder at Myall Creek :—

Spring.—Maize, sorghum, Kaffir corn, broom millet, artichokes, sweet potatoes, cowpeas, soy bean, pumpkins, cattle melons, grammas, mangels, sugar beet.

Summer.—Late maize, sorghum, turnips, rape, vetches, grey peas.

Autumn.—Wheat, barley, oats, rye, field peas, vetches, rape, lucerne.

Winter.—Macaroni wheats and barley.

The kinds of pigs for which climatic conditions of the district are well adapted are Berkshire, Yorkshire, Tamworth, and Large Blacks, with such valuable crosses as York-Berkshire, Berkshire-Yorkshire, and Yorkshire-Tamworth.

The pigs would be fit for the bacon-curer at from seven to eight months old, by which time 150lb. would be a fair average for the district.

In laying out and fencing off areas for pig forage crops, it will be economical of working and management of the depastured animals to have the paddocks long and narrow, so that all the operations of cultivation can be readily performed and the pigs can be restrained with short lengths of hurdle, to prevent vandal trampling of what they for the moment may not be disposed to eat.

The bacon-curing industry would naturally develop into a co-operative concern, so that the farmer could derive all the advantages of having his pigs dressed and cured under conditions most favourable to the production of a high-grade article.

Dairy Farming.

Next to a wheat crop, and, in the opinion of some authorities, ahead of it as a means for the beginner to secure immediate returns in a district like Myall Creek, is a small herd of dairy cows. At the inquiry into the resumption of the estate, a good deal of evidence was given in respect to dairying in the immediate neighbourhood of Myall Creek. One witness instanced a case in the Inverell district where the gross annual return per cow was £10. Another witness, who has not farmed in the district, but who was in the best of positions to speak with a sound knowledge of the matter, suggested the possibility of a man with 150 acres of Myall Creek running thirty dairy cows—twenty in milk at a time—all the year round, at an annual return of £7 to £8 per cow. Of the 150 acres, thirty would be cultivated—ten acres under lucerne, five acres for sheaf hay for chaff, five acres for early barley, five acres in greenstuff, maize, amber cane, &c. Two green crops per year would be obtained from this five acres. For pigs, from which the witness considered an income of £50 per annum could be readily obtained, five acres could be used for the growth of suitable food, principally grain. According to these estimates, the income from thirty cows, and enough pigs to use up the skim-milk, would be nearly £800 a year gross, and such a farm could be managed by the farmer and

two to milk (practically three hands). There has been illustrated in the *Agricultural Gazette* a little dairy farm on the North Coast which the writer had the pleasure of inspecting. It was run by the farmer, his wife, and daughter. They had thirty cows, with twenty in milk at the time of the visit, about eighty acres of land, twenty of which was cultivated, and their gross returns were just a trifle over £240 per annum. Compared with Myall Creek, the North Coast district suffers the disadvantage of being poor lucerne country for the most part.

Management of Dairy Cattle.

A dairy farmer who selects his herd judiciously, and spares no trouble to grow abundance of food for them at all seasons, may still fail to get good returns if he overlooks the question of shelter. In Denmark, Canada, the United States, and other countries where dairying is extensively practised, it is absolutely necessary to house and stall-feed the cows for from five to seven months every winter. In this State, such is happily not necessary, but all the same it will be found profitable to take measures to prevent the diversion of fodder from milk production to maintenance of body heat. If sheds cannot be provided at first to shelter the milkers from wet and cold in winter, rugs should certainly be used, or the milk supply will fail.

Class of Dairy Cattle for which Myall Creek country is suitable.

Where cows are kept under an intelligent system of forage production and shelter, almost any breed can be depended upon to give good returns at Myall Creek.

For the heavier land Shorthorns, Holsteins, and Guernseys will probably do best, while on the lighter land and slopes Ayrshires and crosses of the Ayrshire and Shorthorn or *vice versa* will succeed. Where they can get the very best of attention, Jerseys, as producers of heavy cream yields, can be used with advantage. Beginners are advised to consult the Government Dairy Expert.

Government Stud Bulls.

By arrangement with the Department of Agriculture, dairy farmers may obtain for a small fee (5s. per cow) pure-bred bulls from the State Stud Farms. The bulls are sent into a district on condition that a minimum of thirty cows are paid for. The breeds comprise all the best strains of milking cattle.

Conservation of Fodder.

In a district like Inverell dairy farmers who can maintain a full milk flow throughout the year will have an enormous advantage. With so wide a range of forage crops, and country so well adapted for artificial pastures, there will be little difficulty in doing this.

For the farm horses and dry cattle, hay—lucerne, oaten or wheaten, forms the best class of winter and stand-by feed, but for milch cows

and lambing ewes the fodders must be succulent. Maize, sorghum, oats, wheat, barley, vetches or tares, field peas, cow-peas, grass, thistles, and many weeds—in fact, any plants that stock will eat—can be made at little trouble and very small expense into silage, and in that form retain all their succulence and nutritive qualities. For the purposes of the dairy farmer, silage made from maize and a leguminous crop like cow-peas, which can be sown and harvested with maize, or barley, or oats and vetches, are the most suitable, because they not only produce the necessary cheap bulk, but they, in conjunction with each other, constitute a perfect ration for milk production.

The most economical method of preparing and conserving dairy ensilage is by chopping the material as it comes quite green from the paddock, and storing it in a wooden tub silo. In order to be able to do this, a suitable chaff-cutter, which costs £15 or so, and a tub silo, which will cost about £1 per cow to be provided for during the winter months, will be necessary. Many dairy farmers may not be able to go to this expense at first, but they can have good ensilage all the same by either building the greenstuff into stacks, weighted down with logs, stones, or bags of sand, or they can by making excavations on a hillside, have pit silos in which enormous quantities of the desired food can be cheaply and safely stored.

The right stage at which to cut maize for ensilage is when the cobs are beginning to glaze. Sorghums, wheat, oats, barley, or rye are cut when the grain in the ears is in the dough stage. Cow-peas, soy beans, rape or vetches, field peas, and lucerne are cut when in bloom; grasses of all kinds when the seed panicles are just thrust forth.

Pastures.

Another form of conservation of dairy fodder is in the shape of improved pastures containing a variety of grasses that can be depended upon to come in succession at various seasons of the year. In the North Coast, South Coast, and some other parts of the State, *Paspalum dilatatum* grass is generally regarded as the best summer grass for dairy cattle. It may do well enough at Myall Creek, but there is no evidence that it has been tried there. The conditions are not generally favourable for that grass, but there are many others that will be equally valuable. Among these are cocksfoot, rye grass, prairie, and many members of the clover family. Prairie comes in winter, rye in autumn, while cocksfoot and other grasses, native and exotic, will serve for spring and summer feed.

Many of the native grasses if treated intelligently and allowed to seed occasionally are among the most nutritious of dairy fodders.

Working Stock.

On a mixed farm there is so much horse work to be performed at all seasons that the question of working stock will be one of considerable difficulty.

When purchasing, regard should be paid to the general usefulness of each horse, as it does not pay to keep a lot of one-purpose horses idle six or nine months of the year. It will always pay the mixed farmer to buy good mares, and breed his own horses. Compact, clean-limbed animals will be desirable, and mares of this kind mated with Suffolk Punch stallions will produce an ideal general-purpose farm horse, such as it would cost £35 to purchase. Although in these days of rapid movement people are inclined to regard the working bullock with contempt, to the man of small means this beast offers many advantages. In the first place the individual cost is less, and therefore enough bullocks to do all the heavy preliminary work may be obtained for less than it would cost to purchase even one pair of good plough horses. While the horses, after the rough and tumble of initial ploughing and hauling, are more or less reduced in value and usefulness, the bullocks when they are done with can be fattened up and disposed of to the butcher at a profit, or eaten on the farm.

Implements.

Until a man becomes acquainted with the temper of his soil he should not purchase implements extensively. Taking all the existing factors into consideration, the cheapest, if not the best, way to get virgin land broken up is by contract. The heavy ploughs and big teams necessary for this sort of work are not of much use to the farmer afterwards, and if he wishes to dispose of them it is nearly always at a great sacrifice. At first it is only natural to suppose that many settlers will not be in a position to have much draft or to command the services of much skilled labour, and on that account easily handled and controlled implements will be necessary. With strong iron single or double furrow ploughs, nearly all that is required can be done on a farm where extensive areas of ploughing will never at any time be undertaken, the best results may be obtained, and there will not be a lot of capital urgently required for the development of the place lying idle to rust.

No mixed farm should be without a good scarifier and set of harrows.

In dealing with the black soils, clod-crushers, made of 6ft. pieces of 4 x 4 hardwood diagonally pierced with inch holes, so that they may be fastened together like a drag-harrow, will prove of infinite value.

Transportation of Milk or Cream.

As the dairy industry expands at Myall Creek there will no doubt be established at many convenient centres separating stations for the treatment of the milk from surrounding farms. Until that is done, the plan that would probably be found most economical of the dairy farmers' time, and conducive to the best results in butter-making, would be to have an arrangement whereby the farmer situated at the portion of the estate most remote from the factory depôt could be supplied—co-operatively—with a vehicle and the necessary horses to

take in at the desired times (three times a week, at least) the full cans, and leave the empties at each farm on his return. This would come cheaper to all concerned than if each individual were to undertake his own carrying.

Poultry.

On every farm there should be some poultry to use up scraps, help to keep down insect pests, and to furnish the household with eggs and meat. The best classes for the purpose are Wyandottes or Orpingtons, because they are both good layers and good table birds, and are easily kept within bounds.

Wire netting suitable for yards can be landed at any of the railway stations on and adjacent to the estate for about 4d. per yard.

Fire-breaks.

In some districts summer fires cause enormous loss on farms as well as pastoral holdings. In the case of farms, the loss is in nine cases out of ten due to the fact that in the hottest, driest part of the year the farm area, as the natural result of the mode of working, is like a tinder box. The wheat paddocks carry a bedraggled mass of stripped straw, the headlands wave knee-deep in ripe, dry grass or weeds. The weeds and grass on the rest of the area, which there are no stock to fatten on before the growth becomes rank and dry, are as inflammable as benzine, and spread, without even a few furrows turned to make a break, in an unbroken line from the scrub beyond the boundary to the lintel of the farmstead. A mixed farm is never exposed to this risk. In the first place, at the season when thousands of acres of wheat straw on single crop farms are being put to the match, and when risk of fire is greatest, there is nothing dry to be found on a good mixed farm. The wheat stubbles are buried in the fallow ploughing after harvest. Instead of it being necessary to save grass on its own roots to sustain the stock in summer, the mixed farmer can, on the approach of the hot season, feed down hard the growths that would otherwise become dry and inflammable, because in his rotation of crops there will be plenty of succulent greenstuff coming along for the stock. By working his little flock of sheep on the stubbles he will be able to clear the long grass and weeds from the headlands, and also have everything eaten pretty low around the house and farm buildings. While the single-crop farmer with his firestick in the stripped straw at the very season when everything about the place is bone-dry runs the risk of being burnt clean out any summer, the mixed farmer need scarcely count grass or crop fires as among his risks. Still, the mixed farm is the gradual outcome of years of systematic work. It is just as well to remember that the safest kind of fire-break, and the cheapest, is made by ploughing around the area two parallel strips about 1 chain apart and setting fire to the grass between. Some people plough one side strip and do not clear the grass. It certainly saves grass and space, but to be on the safe side it is better to sacrifice the strip of grass.

Calendar of Farm Operations.

The following calendar is intended to serve as a *guide only*. There are certain to be found slight differences of seasons, according to exposure, elevation, &c., on a tract ranging from 1,250 to 2,000 feet above sea level:—

JANUARY.

Crops to sow—

Potatoes—late, but a small patch might do well.
Swedes—sowing can be commenced.
Rape— do.
Maize—for green feed.
Sorghum— do.
Millets— do.
Wheat—small sowing for green feed.
Barley— do.
Rye— do.

Get land ready for lucerne to be sown in March or April. If teams can be spared, break up wheat and oat stubbles.

Fruit—the soil about fruit-trees should be kept well cultivated to conserve moisture. Get a well-drained patch trenched for strawberries.

Vegetables—sow French beans, cabbage, cauliflower, radishes, and in sheltered nooks, tomatoes.

FEBRUARY.

Crops to sow—

Rape—sow as largely as desired in fine seed-bed.

Kale—sow Thousand-headed for winter feed.

Turnips and Swedes—sow largely for winter feed and market.

Carrots—sow in deep soil.

Barley—Cape and skinless varieties for green feed, alone, or with ½ bushel of tares.

Rye—Emerald rye for green feed.

Wheat—for green feed.

Get land ready for wheat crops for grain, also for lucerne and permanent pasture.

Vegetables—sow French beans, celery, leeks, lettuce, onions, radish, and plant out cabbage and cauliflower.

Fruit—pay particular attention to apples and pears for codlin moth. Examine bandages and destroy fallen fruit. Tie a bit of rag around the stems of the useless trees, so that they can be identified in winter, and worked to more profitable kinds. Plant out strawberries, and get land ready for new fruit trees, leaving soil rough to weather.

MARCH.

Crops to sow—

Rape—for green feed.
Mustard— do.
Kale— do.

Barley—for green feed; alone, or in combination with tares, or vetches, or peas.

Rye—for green feed alone, or in combination with tares or vetches, or peas.

Turnips, Swedes, and Carrots—for winter feed and market.

Feed peas and tares—for greenstuff, silage, or green manure.

Get land ready for wheat sowing next month. Also put in as much time as possible on the land intended for lucerne and permanent pastures. Efforts should be made to get the seed-bed as clean as possible, so that the lucerne or grasses may not be strangled by weeds at their critical stage.

Fruit—get land ready for fresh fruit-trees. Sow tares or vetches, or field peas, for green manure.

Vegetables—set out cabbages, cauliflowers, leeks, celery, beets; prepare land for peas.

APRIL.

Crops to sow—

Wheat—for grain and for hay.

Oats—for hay and for grain.

Barley—for green fodder and for grain.

Rye—for green fodder.

Lucerne—sow as much as land is quite ready for.

Rape—small sowing to keep up succession of greenstuff for sheep, pigs, and dry cows.

Field Peas and Tares—sow as much as desired for fodder and green manure.

Linseed—sow a patch for seed, valuable for old and young stock; also good market demand. Pick richest soil available.

Grasses and Clover—sow in prepared land.

Sheep's Burnet—useful to fill up bare patches in paddocks.

Fruit—at this season the orchard can be allowed to rest. Opportunity should be taken to sow tares or field peas to be turned under as green manure, and to make ready places for any new trees.

Vegetables—sow broad beans, set out cabbages, cauliflowers, celery, shallots, leeks; sow peas, lettuce, carrots, and parsnips.

MAY.

Crops to sow—

Wheat—sowing for grain should be completed.
Oats—for grain and hay.
Barley—for green feed and for hay.
Rye—for green feed.
Lucerne—late, but a small sowing might be made in well prepared land.
Canary Grass—sow for seed, for which there is fair local demand, and as a green fodder.
Onions—sow in clean ground.

Fruit—If green crops have not been sown in orchard they should be put in without delay.

Vegetables—sow largely peas, potatoes, onions, eschalots, parsnips, carrots, cabbage, and Brussel's sprouts.

JUNE.

Crops to sow—

Wheat—it is now late for wheat for grain.

Oats—sow for grain.

Barley—sow for green fodder. This is generally a bad month for sowing, as the crops remain backward until commencement of spring.

Fruit—pruning of fruit trees may be commenced after the middle of the month.

Vegetables—sow peas. As this is the slack month of the year, opportunity should be taken to trench or otherwise prepare areas of new ground for use.

Get land ready for cropping in spring. This is a good time of the year to break up new ground, which can be left rough to weather all winter.

JULY.

Crops to sow—

Wheat—risky for grain.

Oats—may be sown largely if desired for hay.

Barley—sow for grain and green fodder.

Rye— do.

Peas and Tares—sow for greenstuff for pigs and cattle, and for green manure.

Fruit—all pruning should be completed by this time, and trees thoroughly sprayed with lime, salt, and sulphur. Any young deciduous trees should be set out as early in the month as possible.

Vegetables—sow peas and broad beans. Plant onion bulbs and transplant any onion seedlings available. Transplant cabbages, lettuces, and set out rhubarb roots. Get land ready for asparagus. Sow tomato seed in frames to raise plants for early planting out.

Get land ready for early spring crops, by breaking up roughly for exposure to atmospheric influences. Any rough manure available may be spread over land intended for spring planting of potatoes, maize, pumpkins, melons, or tomatoes.

AUGUST.

Crops to sow—

Oats—for hay and grain.

Barley—for green fodder.

Rye—for green fodder.

Peas and tares—small sowing, as it is now late.

Get land ready for potatoes, maize, melons, pumpkins, sorghum, millets, sugar beets, mangel wurzels, and all kinds of spring crops; also for spring-sown lucerne.

Fruit—planting out, pruning, grafting, and spraying should be completed early this month.

Vegetables—plant out asparagus roots in trenched soil, also rhubarb roots. Sow onion seed, and transplant any seedlings available. Sow peas and broad beans, carrots, parsnips, cabbage, and lettuce. Transplant young cabbages and lettuces. Tomato seed may be sown under shelter to raise plants for setting out early.

Get land ready for tomatoes, cucumbers, and all kinds of spring vegetables.

SEPTEMBER.

Crops to sow—

Millet—sow Hungarian for hay and green feed.
Sorghum, Broom Millet, Maize—small sowings may be made on high land.
Potatoes—plant as largely as desired.
Mangolds, Sugar Beets—sow a good patch in rich, deep soil.
Jerusalem Artichokes—set out tubers for crop to be harvested by pigs or stored.

Fruit—The principal work this month will be in connection with spraying for codlin moth, and in finishing off rough ploughing of young orchards.

Vegetables—planting out of asparagus roots and rhubarb roots should be completed without delay. Sow cabbage, lettuce, carrots, parsnips, beet, celery, peas (a few rows), radishes, and turnips. Give land intended for tomatoes its final working with a dressing of wood ashes.

Get land ready for main sowings of maize, sorghum, oats for greenstuff, pumpkins, melons, pea-nuts.

OCTOBER.

Crops to sow—

Maize—make main sowing for grain, green fodder, and ensilage.
Sorghum—for green fodder and ensilage.
Millets—sow for greenstuff and hay.
Broom Millet—sow for heads and grain.
Cowpeas—for green fodder, ensilage, hay, or green manuring.
Potatoes—late, but small plantings can be made. Harrow before they appear above ground.
Mangolds, Field Carrots—sow for winter food for cattle, sheep, and pigs.
Jerusalem Artichokes—set out tubers for harvesting crop for pigs or for storage.
Pumpkins—sow a good patch.

Fruit—If weather be dry, keep soil in orchard stirred with cultivator.

Vegetables—sow all sorts of beans, melons, squashes, marrows, cucumbers, tomatoes.

NOVEMBER.

Crops to sow—

Maize—for green fodder and ensilage; rather late for grain.

Sorghum—for green fodder and ensilage.

Cowpeas—for green fodder, hay, or ensilage.

Pumpkins should be planted without delay.

There will be little time to devote to ploughing this month, as preparations should be made for hay-making and ensilage. If there is plenty of grass, use the first cut of lucerne for silage.

Fruit—keep the soil stirred to conserve moisture, and attend to codlin moth bandages.

Vegetables—sow beans, pumpkins, marrows, squashes, tomatoes, radishes.

Get land ready for late-sown crops for ensilage and winter feed for cows.

DECEMBER.

Crops to sow—

Maize, Sorghum, Millet—sow for green fodder and ensilage.

Rape, Swedes—can be sown towards end of month.

Potatoes—main crop can be planted this month.

Attend to cultivation of all drilled crops, and get land ready for rape, swedes, turnips.

Freight Rates for the principal kinds of Farm Produce, Fencing and Building Material, Implements, Etc.

TO SYDNEY—

	From Gragin Railway Station. per ton. s. d.	Reedy Creek Railway Station. per ton. s. d.	Mt. Russel Railway Station. per ton. s. d.
Wheat ...	14 0	14 0	14 0
Barley ...	14 0	14 0	14 0
Oats ...	14 0	14 0	14 0
Maize ...	14 0	14 0	14 0
Potatoes ...	14 0	14 0	14 0
Hay, Chaff, Straw ... For whole trucks not exceeding 6 tons,	£3 15 2	£3 15 5	£3 15 10
Fruit ...	1 13 8	1 14 0	1 14 4
Butter taken by passenger train during summer months at Goods Rates.	4 7 1	4 7 11	4 8 11

TO NEWCASTLE OR MORPETH—

Wool—Scoured ...	3 18 0	3 18 6	3 18 11
Greasy ...	2 18 6	2 18 10	2 19 2

TO SYDNEY—

Wool—Scoured ...	4 3 7	4 3 11	4 4 4
Greasy ...	3 2 8	3 2 11	3 3 3
Sheep and lambs to Flemington, per full truck, 2-decked...	8 18 1	9 0 2	9 2 6

FROM SYDNEY—

	To Gragin. per ton. £ s. d.	Reedy Creek. per ton. £ s. d.	Mt. Russell. per ton. £ s. d.
Roofing iron (in cases) ...	5 18 8	6 1 1	6 3 11
Fencing wire ...	3 2 10	3 4 0	3 5 4
Agricultural implements ...	3 2 10	3 4 0	3 5 4
Seeds ...	1 9 0	1 9 7	1 10 3

Iron tanks, in parts, same as roofing iron; made up, same as furniture.

	From Gragin to Inverell. s. d.	Reedy Creek to Inverell. d.	Mt. Russell to Inverell. d.
Milk or Cream in cans ...	1 3	10	10

per standard ten-gallon can.

Information for persons desirous of obtaining land under the provisions of the "Closer Settlement Act of 1904."

SUMMARY as to the disposal of lands acquired under the Closer Settlement Act of 1904, setting forth the manner in which lands will be made available for Closer Settlement Purchase, who may apply for same, lodgment of applications, Conditions of Residence, Improvement, and Payment of Deposit, Instalment, and Interest, and other particulars in connection therewith.

Before disposal of land acquired under the Closer Settlement Act, a plan of designed subdivision, conclusive as to areas and values, and showing areas and values per acre of the proposed settlement purchases, will be submitted to the Minister by the Closer Settlement Board.

This design plan will include lands acquired, and any adjacent Crown lands set apart by the Minister for the purpose.

All such lands as aforesaid must be dealt with under the Closer Settlement Act, and in no other way, and will be declared a Settlement Purchase Area or Areas by notification in the *Government Gazette*. Every settlement purchase area will be notified for disposal under the design plan, and may be notified in three classes, viz., Agricultural lands, Grazing lands, Township Settlement Allotments.

This notification will describe the lands fully, will declare them available for application, and will set out, among other things, the class of the land, the capital value for the purposes of each class of holding, and the area in each class which may be applied for to be held in one or two areas.

Who May Apply for Land Under Act.

Any male person not being under 18 years, and any female person not being under 21 years, and not being the holder of any land except town or suburban land, under Crown Lands Act, or land held under lease, as provided in the Closer Settlement Act, or a township allotment thereunder, or land held as a tenant from a private holder, may apply subject to the following provisions. Such person shall not for the purpose of applying under the Act have divested himself or herself of any land held within twelve months before date of application under the Act. Such person, if a female, shall be unmarried or widowed, or, if married, living apart from her husband under an order for judicial separation.

Any person who has lost lands by misfortune, or who has divested himself or herself in good faith of lands, not for the special purpose of applying for lands under the Closer Settlement Act, is not debarred from becoming the holder of a Settlement Purchase.

Lodgment of Applications.

Any person qualified as aforesaid may lodge, either in person or by authorised agent, or by registered post, with the Land Agent of the district in which the land is situated, or with any other officer duly appointed, an application on the proper form, together with a deposit of 5 per cent. of the notified value of any settlement purchase.

Applications, How Dealt With.

Applications received by the Land Agent or Officer duly appointed during office hours of any day of the week from Monday to next succeeding Saturday are deemed to have been lodged simultaneously.

The Land Board will, in open Court, inquire into the merits of each application, and allow or refuse any of them, or permit the withdrawal at any time prior to determination, and may impose a penalty on such withdrawal or refusal, and may disqualify any applicant from making a fresh application for a period. No allowance or refusal of an application can be appealed against.

Residence.

A condition of residence for ten years attaches to every Settlement Purchase, and commences at any time within twelve months after the decision of the Land Board allowing the purchase, but this term may be extended to any date within five years of the allowance of purchase on such terms and conditions as to improvement and cultivation as may be agreed upon between the Land Board and the purchaser. Residence is taken to mean continuous and *bona fide* living, as the purchaser's usual home, upon any Settlement Purchase, or upon any township settlement allotment in the same Settlement Area.

On application on prescribed form, the Land Board may permit the residence condition to be performed in any adjacent village or town; such permission may be conditional or otherwise.

Residence condition may at any time for due cause shown be suspended, either unconditionally or on conditions.

Improvements.

If the land be unimproved, the purchaser must make substantial and permanent improvements thereon to the value of 10 per centum of the capital value within two years from date of commencement of purchase, and to an additional 5 per centum of said value within five years, and to a further additional 10 per centum within ten years from same date. Existing improvements on the land to the amount of their value shall be held to fulfil this condition; and every such purchase shall be subject to such other conditions and restrictions relating to mining, cultivation, destruction of vermin and noxious weeds, insurance against fire, or other matter or matters as may be prescribed.

Deposit Instalment and Rate of Interest.

A deposit of 5 per centum of the notified value of a Settlement Purchase must be lodged with an application. At the end of the first year from date of application, or within three months thereafter, an instalment on the purchase money at the rate of 5 per centum of the capital value of the land, and thereafter in like manner a like instalment annually until the balance of purchase money, together with interest at the rate of 4 per centum per annum thereon, has been paid; but two or more instalments may be paid at the same time. The incidence of payment is shown by the following table:—

Capital Value £100
Deposit £5
Annual Instalment £5
Interest on Unpaid Balance... 4 per cent. per annum.

Year.	On Account of Interest at 4 per cent.	On Account of Principal.	Balance of Principal.
	£ s. d.	£ s. d.	£ s. d.
1	....	5 0 0·0	95 0 0·0
2	3 16 0·0	1 4 0·0	93 16 0·0
3	3 15 0·5	1 4 11·5	92 11 0·5
4	3 14 0·5	1 5 11·5	91 5 1·0
5	3 13 0·0	1 7 0·0	89 18 1·0
6	3 11 11·1	1 8 0 9	88 10 0·1
7	3 10 9·6	1 9 2·4	87 0 9·7
8	3 9 7·6	1 10 4·4	85 10 5·3
9	3 8 5·0	1 11 7·0	83 18 10·3
10	3 7 1·9	1 12 10·1	82 6 0·2
11	3 5 10·1	1 14 1·9	80 11 10·2
12	3 4 5·7	1 15 6·3	78 16 3·9
13	3 3 0·6	1 16 11·4	76 19 4·6
14	3 1 6·9	1 18 5·1	75 0 11·5
15	3 0 0·5	1 19 11·5	73 0 11·9
16	2 18 5·3	2 1 6·7	70 19 5·2
17	2 16 9·3	2 3 2·7	68 16 2·5
18	2 15 0·6	2 4 11·4	66 11 3·1
19	2 13 3·0	2 6 9·0	64 4 6·1
20	2 11 4·6	2 8 7·4	61 15 10·7
21	2 9 5·2	2 10 6·8	59 5 3·9
22	2 7 5·0	2 12 7·0	56 12 8·9
23	2 5 3·7	2 14 8·3	53 18 0·6
24	2 3 1·5	2 16 10·5	51 1 2·1
25	2 0 10·2	2 19 1·8	48 2 0·2
26	1 18 5·8	3 1 6·2	45 0 6·0
27	1 16 0·2	3 3 11·8	41 16 6·2
28	1 13 5·5	3 6 6·5	38 9 11·7
29	1 10 9 6	3 9 2·4	35 0 9·3
30	1 8 0·4	3 11 11·6	31 8 9·7
31	1 5 1·8	3 14 10·2	27 13 11·5
32	1 2 1·9	3 17 10·1	23 16 1·4
33	0 19 0·5	4 0 11·5	19 15 2·0
34	0 15 9·7	4 4 2·3	15 10 11·7
35	0 12 5·3	4 7 6·7	11 3 4·9
36	0 8 11·2	4 11 0·8	6 12 4·2
37	0 5 3·5	4 14 8·5	1 17 7·7
38	0 1 6·1	1 17 7·7	....
	86 19 1·9	99 19 11·9	....

Restriction on Purchase.

No person, unless qualified under Section 26 of the Act, the provisions of which are set out on page 1, under the heading, "Who may apply," can make or acquire, by way of transfer or otherwise, a Settlement Purchase under the Act, nor can any person make, hold, or acquire more than one Settlement Purchase. This provision does not apply to transfers by way of mortgage, and where a Settlement Purchase devolves under a will or intestacy upon a person who is not qualified to hold the same, such person may, nevertheless, so hold for a period of three years, or such further period as the Minister may permit.

Transfer and Mortgage.

Before grant, no holder of Settlement Purchase shall transfer, convey, or assign or lease such purchase or mortgage or charge without the written consent of the Minister, except payment of balance of purchase money has been made. The Minister shall be satisfied that all conditions have been and are being complied with.

Any mortgagee who has under power of mortgage submitted any Settlement Purchase for sale by public auction, and any execution creditor who has seized under process any such purchase and so offered the land for sale may, if interest be not sold to qualified purchaser, go into possession. If a condition of residence attach, such shall, for a period of two years after commencement of possession or further approved period, be deemed to be fulfilled if a nominee of mortgagee or creditor (to be approved by Chairman of Land Board) reside. Mortgagee or creditor shall, within two years or further approved period, sell mortgagor's or debtors' interest to *bona-fide* purchaser, who must be a qualified holder under the Act, and be subject to all conditions of original holder. In default of sale, settlement purchase shall be liable to forfeiture.

Any person before making avail of these provisions shall register at the Crown Lands Office in the district in which land is situated the amount of mortgage or judgment debt, and any qualified person may thereafter, prior to exercise of power of forfeiture, apply to the Land Board to purchase the holding for amount of debt. If the Land Board grant such application upon payment to mortgagee or creditor of amount due, the applicant shall become the holder of land free of debt but subject to all unfulfilled conditions.

Death or Lunacy of Holder.

In the event of death or declared lunacy of any holder of any settlement purchase to which conditions attach, such conditions shall be performed by the representatives of the holder, either personally, or by agent approved by Chairman of the Land Board.

Issue of Grant.

After fulfilment of residence conditions, and payment of balance of purchase money, on finding of Land Board that conditions have been fulfilled to date, the Governor may issue grant.

Inquiries as to Fulfilment of Conditions.

The Land Board may at any time, and from time to time, hold inquiry in open Court as to whether conditions have been, or are being complied with; if found that conditions have not or are not being complied with, the Land Board shall so report to the Minister. The Land Board's finding to be subject to appeal to the Land Appeal Court, in the same manner, and within period provided for Appeals under Crown Land's Acts.

Forfeiture.

Any holding under this Act shall be liable to forfeiture if all or any of conditions have not been complied with. The Minister may waive forfeiture unconditionally or conditionally as he thinks fit. The Governor may, by *Gazette* notification, declare forfeiture of holding, and all moneys paid in connection therewith, or by a like notification reverse forfeiture.

Leases.

The Governor may set apart and lease land under this Act in areas not exceeding 320 acres. Leases shall be applied for in the prescribed form, and subject to such conditions as may be determined, and the following provisions:—

Improvements are not to be effected without consent in writing of the Minister or Chairman of the Land Board.

A Lease is to be for the current year and expire on 31st December, but may be renewed from year to year, by payment of yearly rent in advance not later than 10th December of next preceding year.

The Rent is to be appraised by Land Board. The granting of a lease not to exempt land from being granted as Settlement Purchase. Lease of so much of land the subject of a valid application for a Settlement Purchase shall cease from date of that application, and rent of Lease shall be adjusted.

The Minister may at any time cancel Lease by giving not less than three months' notice in *Gazette*, such notice to terminate Lease at end of then current year.

Persons desirous of obtaining full particulars as to plan of subdivision, character of soil, and date when land will be available for Closer Settlement Purchase, should at once register their names and addresses with any Crown Land Agent in the State, or at the Inquiry Branch, Lands Department, Sydney.

Mixed Farming at Bathurst Experimental Farm.

W. H. CLARKE.

Of all forms of occupation and utilisation of the soil, the intensive cropping and stocking of a comparatively small area under the system of what is generally known as mixed farming, is the most fascinating, as it is also the most profitable, not only to the farmer himself but to the children who succeed to his acres. All parts of this State are not naturally adapted for the practice of a complete system of mixed farming, but many millions of acres of the coastal, tablelands, and western slopes districts, possess ideal conditions for the rotation of a variety of crops in conjunction with a small flock of sheep for fat lambs, a few cows, some pigs, a good brood mare or two, poultry, an orchard, a vegetable garden, and a little experiment patch to feel the way in the introduction of new crops, manures, and methods.

The Bathurst Experimental Farm furnishes an excellent object-lesson of mixed farming on lines that are commercially practicable and so simple that any man who wishes to make the utmost return from his farm and run it as a business that will yield him substantial profits in the bad seasons as well as the good years, can at once see how the system is managed and put it into practical effect. Some people, when they see a mixed farm in full swing, will say, "Oh, I have not the means to lay out my paddocks like this; I cannot afford a big flock of good sheep; how am I to get the money to plant out an orchard or do any of the many things I see all around?" Considering that a mixed farm in full operation and equipment, with every blade of stuff that shows above ground being diverted into some profitable channel, is about the most valuable class of property any man can possess, it is no wonder that the person who is under the impression that the thing is the growth of a year or two does entertain such doubts. It must be remembered, however, that a mixed farm, as a going concern, is the natural but gradual outcome of common-sense farming on strictly practical and businesslike lines. Indeed, the ability and desire to spend a lot of money at the outset may prove, and it has done so in many instances, a serious impediment to the successful development of a mixed farm as a profit-producing concern. The man of unlimited means may, in his haste to get the equipment complete, attempt to do by artificial means what nature has ordained shall be brought about gradually by good tillage, following a rotation of crops and the depasturing of stock; or he may launch out extensively in many ways with crops, and incur the risk of failure which would never have been met with had he been forced to cautiously feel his way. It will thus

A bird's-eye view of Bathurst Experimental Farm, December, 1904.

be seen that once it is realised that the fundamental principle of "mixed farming" is "safe farming," there is no reason why the man who starts with but little ready cash may not in time have quite as successful a mixed farm as the man who starts with a big bank account. Good mixed farms are unfortunately a good deal scarcer than they should be in the suitable districts of this State, but, when a conspicuously successful one is met with, it will generally be found that the prosperous owner of it started with very slender capital.

But, while in all the districts above mentioned there are countless acres suitable for mixed farms, all men are not fit to become mixed farmers. It is only the men of good capacity, and those who are systematic and businesslike, who can succeed. Two men may settle in a good district on adjoining blocks of equal size. One man aims at having in course of time a mixed farm, because his business instinct prompts him to recognise the insecurity of dependence upon any one string in this world. The other prefers to go for a big cheque in one lump. During the first few years, if the seasons be favourable, the big-cheque-in-one-lump man fairly runs rings around his neighbour, who is always pottering with small areas and runs a concern that is something between Noah's Ark and a Chinese market garden. When the time comes for getting in his single crop the big-cheque man has simply to get his land ploughed, and he does it easily and cheaply, because it is in one unbroken stretch from boundary to boundary. When the crop is in he has nothing to bind him to his farm for several months, and

he can have a good spell if he feels like it. At harvest there is no worry and labour of stooking, carting, stacking, thatching and threshing. The stripper is cheap and simple, and, when the grain is gathered, the application of a match to the straw will do the rest. He feels a certain amount of pity for the neighbour whose work is never done, until one fine day it occurs to him that something extraordinary has happened to the climate, or that there is some advantage of aspect in the neighbour's holding, since the wheat crops and everything else there are doing tip-top, while his own are very poor indeed. Next season perhaps the rainfall is below the average. He watches it most carefully. He is convinced that the boundary fence does not keep the rain off his land, yet the pottering neighbour's small areas are yielding heavily. Then perhaps it will dawn upon the big-cheque-in-one-lump man that while his system of a single crop in uninterrupted succession has had the effect of running his soil down and rendering it liable to parch more rapidly every successive season, leaving him nothing but a comfortless home, a few weatherbeaten implements, worn out horses, and the prospect of even worse crops in the future unless he can afford manure, that of his neighbour has gradually resulted in an attractive home, bountifully supplied with all sorts of comforts, very respectable flocks and herds, and soil so improved that it is easy to work, and capable of producing something even in a drought. Moreover, the big-cheque man may see his sons as they grow up become disgusted with the monotony of the home and its surroundings and leave it for the towns, while the young people are sticking to the mixed farm which their own common-sense convinces them will be a still better farm when they inherit it.

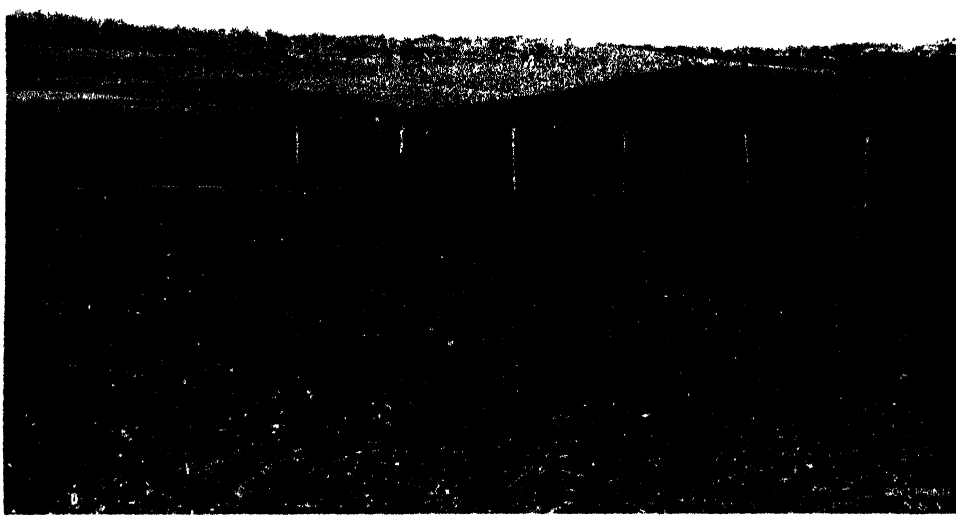
So much for the sermon. When the Bathurst Experimental Farm sites—there are two: one of 620 acres on the hills above the city, and the other of 16 acres on the Macquarie bank—were chosen, it was argued that they were both extremely unsuitable. The large area, it was said by people who had farmed in the district for half a century, was composed of such inferior soil as to be fit for nothing but the racecourse, for which it had been used for many years. The smaller area was said to be composed of soil, very rich, but so difficult to work that it could scarcely in such a district pay for the expense of irrigating and working it. The writer has had opportunities of seeing the development of both areas at every stage.

When the old racecourse was first broken up, the predictions of all the old farmers in the district certainly seemed to be true. When the ploughs tore through the crust that was set like mortar, the clods turned up were as big as a man's body and as harsh and ragged as rubble. Gazing down on a ploughed paddock from the hill, the rough mass of all colours in irregular patches looked utterly hopeless. Now, the old brood mares, with their foals capering beside them, sweep with swinging chains the plough through this same paddock, which has had 16½ inches of rainfall in the twelve months, and the soil, dark and mellow, is as crumbly as garden mould. Where the old race-track and the broad roadway leading to the grandstand traversed the area, there stretch nearly 100 acres of wheat as level as a

billiard table throughout. The change is, indeed, marvellous; yet it has been wrought simply enough.

On the opposite page will be seen a bird's eye view of the greater portion of the 400 acres which have been brought under the plough. The higher land above the orchard is still uncleared and comprises about 200 acres left just as it stood when the farm was established.

The preliminary crop in each paddock was wheat or oats. As soon as the wheat was taken off, the ploughs, multiple furrow, were put in, and before Christmas, as a rule, the paddock lay roughly broken up in readiness to catch and retain every drop of rain which might happen to fall until February, when it was sown to rape. On this crop the sheep would run from July to October; then the land would be broken up roughly again, and perhaps put under maize or allowed to lie fallow until April, when it would be ploughed and prepared for a wheat grain or hay crop. For several years the area of the farm



A view of the cultivation paddocks, Bathurst Experimental Farm, December, 1904.
The paddock in the foreground is lying fallow; the area to the right is under cowpeas, which are just coming up.

under cultivation was not more than one-fourth of the whole extent. Paddock by paddock was taken in hand until the present breadth of 400 acres was brought into active use. All the time experiments were in progress to determine, at first in a small way, what crops and varieties of crops, were most suitable to the conditions of the district, and as the special fitness of any one became apparent it was used in the rotation on the paddocks. Thus, this season, there is to be seen on an area (to the right), which carried wheat last year, a crop of cowpeas, of the black variety, coming along very nicely. In the same paddock, a strip of several chains wide, has been left under bare fallow. Any one who desires to learn the practical effects of the use of the cowpea in a cereal and rape rotation, will thus be enabled to see, first of all, the quantity of fodder that will be available for grazing off

by sheep, and then the results of the next grain crop, having for a basis of comparison the bare fallowed portion of the paddock; and if they wish to go further, the best paddock among the private farms in the district, which is cropped in unbroken succession—say, three times—with wheat, might be inspected. In the foreground will be observed a very roughly broken paddock, which is lying as bare fallow. To the right of the paddock of oats, in which the tree is standing (see view on p. 143), is a 10-acre area devoted exclusively to trials with manures under the direction of the Departmental Chemist, Mr. F. B. Guthrie, and also by the Manager of the Farm, on a large scale. In his series of tests, Mr. Guthrie uses a wide variety of manures in varying proportions, so as to derive comparative data from season to season.

To the left of the long stretch of standing crop (John Brown, one of Mr. Farrer's wheats), Mr. Farrer's wheat trials are in progress. The

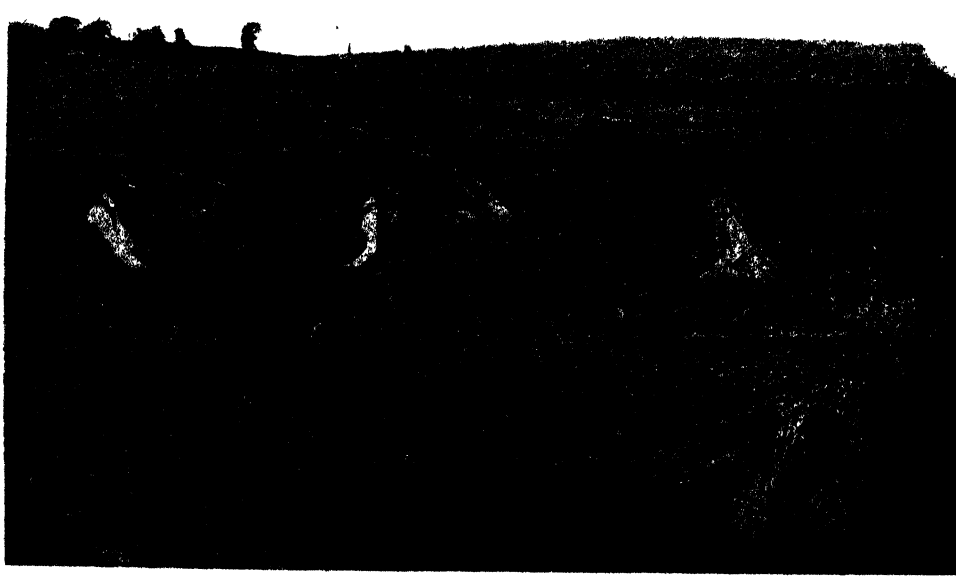
Bathurst Experimental Farm December, 1904. Some of the 10-acre demonstration areas.

crop of Bobs, grown on a commercial scale this season, was particularly even in growth, and returned 24 bushels per acre.

On a little slope, just beyond the tub-silo, Mr. Peacock has a few acres under maize, with pumpkins growing between the rows. At the time of visit, both the maize and the pumpkins on this area were looking remarkably well—in fact, better than the maize and pumpkins down on the irrigation section. Deep ploughing of a soil enriched and rendered retentive of moisture by the turning under of the droppings of depastured sheep and the balance of the stubble of an oat crop, and constantly stirred with a horse-hoe, being responsible for the good results. The same is found in every paddock, and the crops are such as one would look for in a good season rather than the sort of one that the condition of crops on the surrounding farms would lead one to suppose had been experienced.

Throughout the district, away to the east as far as Raglan, then through Glanmire, Dunkeld, White Rock, and all around—a journey of about 70 miles in all—the crops were poor. In many instances the

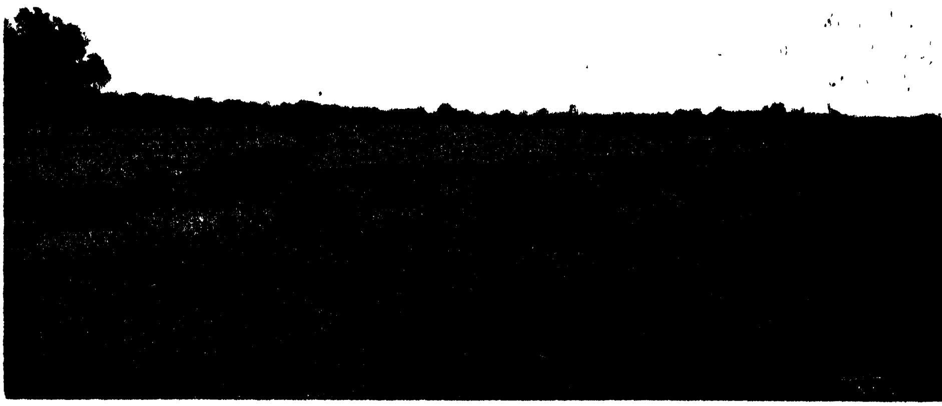
failure was absolute, and at best there were but a few cases where the return from patches of the area sown reached as high as 16 bushels. A bag, or 5 bushels at most, might be set down as the average yield. Every acre of these miserable crops emphasises the fact that the system followed is the wrong one for the conditions of the district. Some of the soils have certainly been worked out, but, generally speaking, they are superior to what the Bathurst Experimental Farm soil was even in its virgin state. It is a great pity that Mr. Peacock has not set aside a portion of the still unused portion of his farm to be worked on the system that prevails in the district. Certainly the ultimate effect would be to ruin the area so set aside, but still the demonstration might afford an even more striking object-lesson to all concerned. It is quite possible that in some cases attempts may be made to restore the productiveness of some of the wheat areas by the use of quick-acting manures. If there be a favourable season, the desired result for that season will be achieved no doubt; but what if there comes a bad season? How is the farmer who has received from this season's operations scarcely enough to pay the cost of growing and harvesting going to bear the extra expense? Would it not be better to discard the system that produces so little profit? The first step on nearly every holding would be to reduce the annual cropping by one-half. It stands to reason, or at least it



Bathurst Experimental Farm, December, 1904. The crop being harvested is second growth.

appears to do so, that if a man cannot manage to get 200 acres ploughed and sown in such a way, and by such a period of the season, as will give it a fair chance to succeed, he will have a better opportunity of doing what is necessary if the work be decreased by half.

Surely it is better to get, as Mr. Peacock has got at the Bathurst Experimental Farm this season, 2,000 bushels of marketable wheat from 100 acres, at a working cost all told of £1 10s. per acre, than it is to have to plough, sow, and harvest, with all the injurious effects



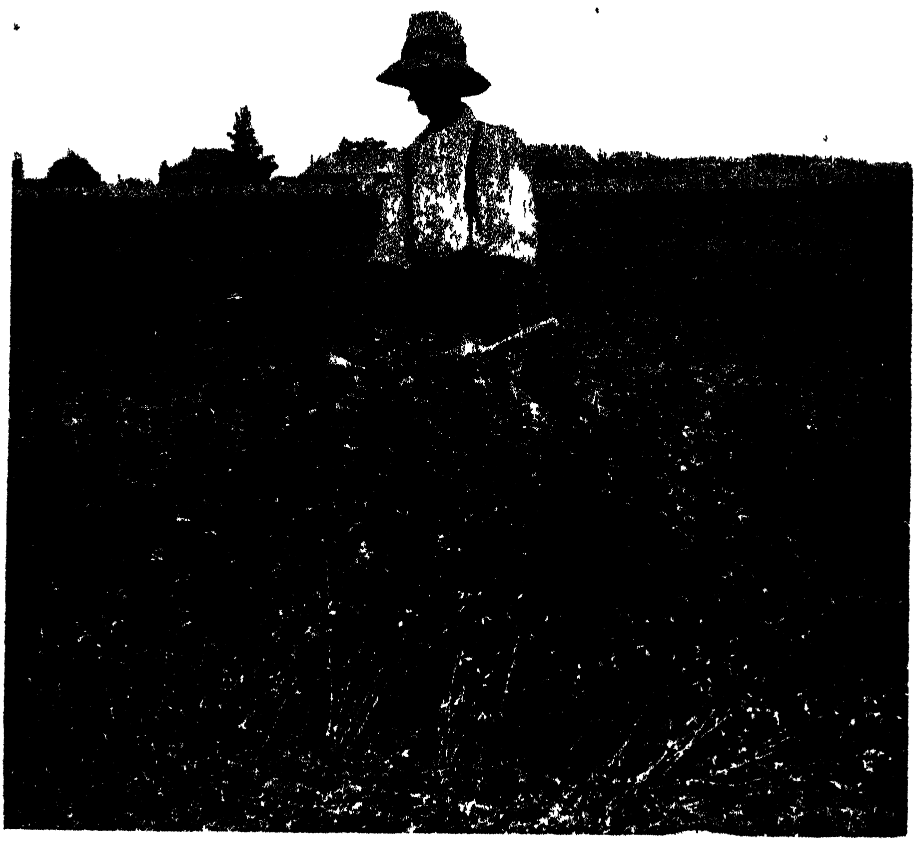
Bathurst Experimental Farm, December, 1904. Harvesting Oats.

upon the machines, 400 or 500 acres for such a total return. Even if the system of the farmer, being less elaborate, should cost him less per acre than the work of the Experimental Farm, does the few shillings per acre difference represent fair compensation for the enormous difference in the labour involved in the working of 400 acres as against 100? It may be right enough for the man of capital who is not entirely dependent upon his crop returns to rush in a big area on the off-chance of a good season, but the man who is farming for a livelihood simply cannot afford to do so.

Having carefully gone into every phase of the question, and satisfied himself by the simple process of seeing with his own eyes how results better than his own are obtained, the man of small means who is desirous of getting into a safer and more profitable line on this class of country may perhaps be able to see that, if his cropping is to be reduced by half, he may be able to raise in the same way—as he may have to raise it to pay for the labour and harvesting of the full area—a few pounds to make a start with some sheep. On some of the farms, even twenty ewes would be a perfect godsend to clear up some of the weeds that infest the wheat paddocks. It may seem a ridiculous idea to a farmer who has been in the habit of cropping 300 acres of wheat and running a business with an annual turnover of, say, £450, to suggest that he run a business with an annual turnover of, say, £337; but when all is said and done, it is the proportion of profit that tells. Say he can put his 300 acres in and take it off under the old method at 25s. per acre, out of £450 gross returns his profit is £75 for the season. Suppose he fallows his land to give the subsoil a chance of getting saturated, like they do at the Experimental Farm, and it costs 5s. an acre more to do this bit of rough ploughing, and he gets 5 bushels increase in consequence, the profit from the turnover of £337 will be £112.

LUCERNE-GROWING AT BATHURST.

On the riverside section of Bathurst Experimental Farm, Mr. Peacock is conducting a number of experiments of importance to the pastoralist as well as the farmer. It is often quite an easy matter to find on a large holding one or more areas of land, on the banks of a river or



A month's growth of Lucerne under Irrigation, Bathurst Experimental Farm.

creek, upon which lucerne could be grown under irrigation. The difficulty generally is that through lack of sufficient knowledge as to the preparation of the areas for irrigation, and the most effective methods of applying water, the crops do not succeed.

In the accompanying illustration will be seen lucerne grown in checks, some of which are perfectly level; others slightly on an incline. In larger areas the lucerne has been sown broadcast and in drills.

Experimental Plots of Lucerne in level and inclined checks, $\frac{1}{10}$th acre each, Bathurst Experimental Farm, Irrigation Area.

The illustrations speak so plainly for themselves that comment seems to be unnecessary. However, it might be mentioned that from a trial check, $\frac{1}{10}$th acre in extent, it is customary to cut throughout the spring and summer months three cart loads of greenstuff every four or five weeks.

Experimental Plots broadcast and drilled Lucerne, Bathurst Experimental Farm, Irrigation Area.

Notes on Sheep at Bathurst Experimental Farm.

R. W. PEACOCK.

Considerable attention has been given to the breeding of cross-bred sheep at this farm, in order to demonstrate which crosses are the most desirable for the production of fat lambs suitable for the English markets upon country of which this farm is typical, viz., the Tablelands. This work is of considerable importance to the farmers in such

Sheep at Bathurst Experimental Farm. The structure to the left of the tree is a tub-silo.

districts, who eventually must rely upon mixed farming to get the most profitable return from their holdings. The production of export lambs should be taken up seriously by the farmers, thus adding to their resources one of the most stable and profitable sections of a system of agriculture admirably adapted to Australian conditions.

The arriving at satisfactory conclusions is not an easy task in experimenting with live stock, and in the case of the many experiments carried out at this farm, some allowance must be made for the various factors, such as the individuality of the rams used, and the limited number of each entering into the experiments. Typical rams of each breed were obtained for the purpose, and ewes of uniform type and quality were mated with them. During the past year rams of the following breeds were mated with Merino ewes of fair average quality, the ewes being purchased at 12s. per head in 1902 :—Lincoln, Border-Leicester, English-Leicester, Shropshire, and Southdown. The lambs were weighed at the age of 7 months, the following being their average live weights :—

Lincoln x Merino half-breds	$92\frac{17}{26}$ lb.
Shropshire x Merino ,, ...	$84\frac{3}{4}$,,
Border-Leicester x Merino half-breds ...	84 ,,
English-Leicester x Merino ,, ...	$82\frac{5}{14}$,,
Southdown x Merino ,, ...	72 ,,

By reducing these averages by 50 per cent., some idea of their dressed weights would be gained, as, roughly speaking, lambs in good condition lose about 50 per cent. when dressed.

Fifty of the best hogget ewes were kept for breeding purposes, and were shorn when 12 months old, the following being their average weight of wool:—

	lb.	oz.
Lincoln x Merino ewe hoggets	9	4
English Leicester x Merino ewe hoggets ...	8	9
Border-Leicester x Merino ,, ...	8	6
Shropshire x Merino ,, ...	8	0
Southdown x Merino ,, ...	6	10

A pen of each of the various crosses were exhibited at the Sheepbreeders' Show in Sydney. They were made up of weaners 7 months old; the Lincoln-Merino were three weeks older than the others, being nearly 8 months old. This should be taken into consideration when comparing their weights.

Pen No.	415, Lincoln x Merino, half-bred	weaners,	average live weight,	107 lb.
,,	410, Shropshire x Merino	,,	,,	94 ,,
,,	413, Border-Leicester x Merino	,,	,,	$93\frac{2}{5}$,,
,,	414, English Leicester x Merino	,,	,,	86 ,,
,,	411, Southdown x Merino	,,	,,	90 ,,

The following is a report upon these by Mr. Hawkesworth, the wool and sheep expert of the Sydney Technological Museum:—

"Pen 415, Lincoln x Merino half-bred weaners.—This pen offers a good object-lesson, and is full of instruction; it is rarely one comes across weaners of this age with so much size and equal to the majority of hoggets at ten or eleven months' growth. They are of a most uniform build of great size, considering the age, and with a little extra feeding would quickly develop into great weights. These young sheep have evidently stood the dry season better than any other cross from the farm, and in every respect are a most creditable production, and may be called the poor farmer's sheep. The wool has a good lengthy bold staple, very bright, and of soft texture, although the fleeces varied in quality.

"Pen 410, Shropshire x Merino half-bred weaners.—These weaners are very well-grown, and have evenly-balanced forms, deep in front, and well let down quarters, indicating good meat-producers. In their present state there is a great proportion of meat, with a minimum of offal, and if given a little forcing food these weaners could be made into useful weights. Even in their present condition, just off the grass, they are desirable meat and satisfactory weights. The wool is well-grown, with a fairly heavy fleece of good quality and character.

"Pen 413, Border-Leicester x Merino half-bred weaners.—Under favourable conditions this is a most serviceable cross, but require better treatment than any of the Downs crosses. These have good frames, and with a little more time and liberal feeding could be made good weights, for either export or local consumption. The wool is a very desirable type, carrying good length, nice character and fine for the cross, and is much more valuable than the Downs cross.

"Pen 414, English-Leicester x Merino half-bred weaners.—A very even pen of cross-breds, very similar in form and general appearance, but I would have liked to have seen larger frames. No doubt these young sheep have felt the effects of an adverse season; still, under any conditions, this cross does not mature so quickly as most crosses. The wool is excellent, and is a high class of cross-bred; although a half-bred it would be readily purchased for a comeback. If the ewes were put to a Merino ram it would be an interesting experiment, and, in my opinion, a really good fine comeback would be the result.

"Pen 411, Southdown x Merino half-bred.—A pen of nicely built weaners, heavy in the flanks and would give weighty legs of mutton of prime quality. They are fairly well-grown, evenly moulded, and handy weights for export, and with a little topping up would soon be prime. The fleeces are rather open, short and in light dry condition, a little inferior alround when compared with the half-bred Shropshire x Merino pen."

As before stated, it is extremely difficult to arrive at satisfactory conclusions owing to the various factors over which it is difficult to have control. Nevertheless, from the experiences gained throughout the years these experiments have been carried out, much information has been gained which should prove of considerable benefit to many who are desirous of taking up the work. The objects of the breeder should be to produce an early maturing lamb suitable to his conditions, commanding a ready sale for export and to obtain as great a return as possible for the wool from his breeding ewes. With these objects in view, the following recommendations are made:—

It is preferable to breed from 6-tooth ewes, which have already dropped one lamb, as younger ewes losing their teeth cannot do justice to their lambs, if the seasons are at all unfavourable.

Breed from fair to good ewes; old culls will not give satisfactory results.

Half-bred ewes make better mothers than pure Merinos, having a larger percentage of lambs, which they rear more satisfactorily.

Lambs should be ready for sale at from 4 to 5 months; to ensure this green food should be provided for the ewes during the winter, and also the dry summers.

Lambs for export should weigh from 30 to 40 lb. dressed weight.

In choosing English rams for mating with Merino ewes, large heads should be avoided, if possible, without sacrificing masculinity.

The crosses strongly tc be recommended for the conditions of this district are those from Lincoln x Merino half-bred ewes, and from Border-Leicester x Merino half-bred ewes, mated with Shropshire rams.

Good rams of the various breeds should be used.

Good lambs must have good mothers, and good mothers must have good pastures, or substitutes for them.

Cheddar Cheese as it is made in the Waikouaiti Dairy Factory, Otago, New Zealand.

By W. GRAHAM,
Assistant to Dairy Expert.

THERE are eight successive periods in cheese-making, which may be termed—the setting, cutting, cooking, matting, milling, salting, pressing and curing periods. When the supply of milk has been received into the factory, it should be heated to a temperature of 86° F. A rennet test should then be taken, to find out the ripeness, or, in other words, the amount of acid which may have developed in the milk. There are several rennet tests, but the simplest and one which is in general use is what is termed the cup test, viz., 1 dram of rennet to 4 oz. of milk at a temperature of 86° F.; the rennet is stirred into the milk, and the time it takes to coagulate is taken in seconds; if it thickens in 18 seconds, and you find that by setting your milk, in the vat, that the time between setting and wheying off was from two and a half hours to three hours, which is the required time to get the curd properly firm in the whey, you would know then to go on from day to day setting at the 18 seconds; if, on the other hand, the acidity developed too quickly to allow the curd to remain that time, it would be advisable to set earlier, say 20 seconds. If the milk has not developed enough acidity to warrant it being set, a little starter should be added. Three to four ounces of Hansen's extract of rennet is sufficient to coagulate 1,000 lb. of milk; the rennet should be diluted in water and stirred into the milk in the vat; the stirring to continue from three to four minutes to ensure it being properly mixed; when the rennet is not properly mixed with the milk, the curd sets firm in some places and soft in others, thereby, a good deal of waste takes place when it is being cut with the knives. A time and a half plus the time it took to thicken is sufficient to allow the curd to become firm enough to cut; that is to say, if it takes twelve minutes from the time the rennet is added until the milk begins to coagulate, then in thirty minutes the milk will have thickened and become set and firm enough to be ready to cut.

A good way to try the curd to see if it is sufficiently firm to cut, is to wet the finger and dip it in a slanting direction into the curd; if the curd breaks readily and clean over the finger, it is time for cutting.

Cutting.—The horizontal knife should be used first, and care should be taken in this operation not to break the curd whilst being cut longitudinally or up and down the vat. The perpendicular knife is then used across the vat, and then up and down the vat; in this operation, the curd is cut into square cubes of about ⅜ of an inch. The curd is now stirred with the hands for a few minutes before the heat is applied, to allow the whey to separate from the cubes. The curd being soft at this stage, it should not be treated

roughly, or a good deal of waste will take place. Then the rake or agitator is used, and the heat applied slowly; the temperature should be raised from 86° F. to 98° F., at the rate of 2° in five minutes. Although this is called the cooking stage, the word is misleading, as expelling the whey from the curd would be more to the point. The stirring should be continuous for an hour from the time the heat being first applied. If the lactic acid shows signs of developing quickly (as per trial with the alkaline test), a good deal of the whey could be run off, just leaving sufficient to cover the curd, which should have shrunken to nearly one half of its former size. If the acid still shows signs of developing too quickly, all the whey could be run off, and good clean water at a temperature of 100 degrees added, which would help to retard the development of acidity, and also allow the curd time to become firm and properly cooked. At the end of the cooking stage the particles of curd should have become so firm that, when pressed together between the hands, and the pressure suddenly relaxed, they will fall apart and show no tendency to stick together. A quarter of an inch of acid by the hot-iron test is about the general thing required; but, of course, this varies according to the flavour and condition of the curd, and also the richness of the milk. Care must be taken at this stage that too much acid is not given, or a bleached and sour cheese (or what cheese-makers call an acid-cut cheese) will be the result. The next period is the cheddaring or matting period. The curd is thrown on wooden racks placed in the bottom of the vat and hand stirred for a time, the object being to drain the whey from the curd. Then it is thrown together and allowed to mat, and the vat is covered with a cloth or canvas covering. In the space of about fifteen minutes, the particles of curd will have sufficiently adhered to allow cutting into square blocks which should be turned over at intervals of ten minutes, thus causing the whey to be ejected from the masses of curd. The time allowed for matting is two hours, and the temperature throughout this stage should be 90° F. so that the production of lactic acid is not checked. From the condition of a tough spongy mass when first cheddared, the curd changes into a smooth flakey substance, and should show about 2 inches of fine threads on the hot iron.

Milling.—The curd should now be milled and spread over the bottom of the vat and hand stirred or aired. The object in airing is to improve the flavour, inasmuch as it allows the gas which may have accumulated in the curd to escape, while further maturing of the curd takes place, in which it develops a nutty flavour, and a nice silky feeling.

Salting.—The curd is now ready for salting. The quantity of salt is generally from 2¼ to 3½ lb. per 1,000 lb. of milk, but the condition of the curd must be taken into consideration—a soft curd requires a little more salt. The salt being sprinkled over the curd and thoroughly mixed, three or four minutes should elapse to allow the salt to dissolve before putting to press.

Pressing.—In putting the curd to press, the temperature should be from 78° to 82° F. With high temperature at pressing, the fat is more easily pressed out and lost. On the other hand, if the

curd is at too low a temperature when put in the press, it is more difficult to make the particles adhere in a solid mass. The pressure should be applied gently at first, and the lever of the press tightened every two or three minutes, thus allowing the curd to set. An hour should elapse before dressing, and the chesse should remain at least twenty hours in the press, with a continuous pressure all the time.

Curing.—60° to 65° F. is as high as any curing-room should be. Good results cannot be obtained at temperatures higher than that. The cheeses should be turned every day, thus allowing the rind to dry and the cheeses to retain their shape. At a temperature of about 65°, cheese will break down readily and become marketable in six weeks. In cheese for shipping better results will be obtained by curing at a lower temperature, as the result will be a milder cheese, and one which will not be so liable to go off in flavour.

The characteristics of a good cheese are: The flavour should be clean—that is, free from any flavour due to the influence of undesirable fermentations or to foreign matters that may have gained access to the milk. The body should be firm, and, when broken down between the finger and thumb, should show a silkiness. The plug should break clean, showing a flinty break. The colour a transparency resembling in a pale cheese the colour of amber. The rind should be smooth without cracks, and the bandage should extend over the ends of the cheese for about 2 inches, and should be smooth and straight.

In judging cheese, the standard of perfection is taken at 100 thus:

Flavour	50 points.
Body and texture ..	30 ,,
Colour	15 ,,
Finish	5 ,,
Total	100 ,,

COPY of Report by the English buyer on Cheese made by the writer:—

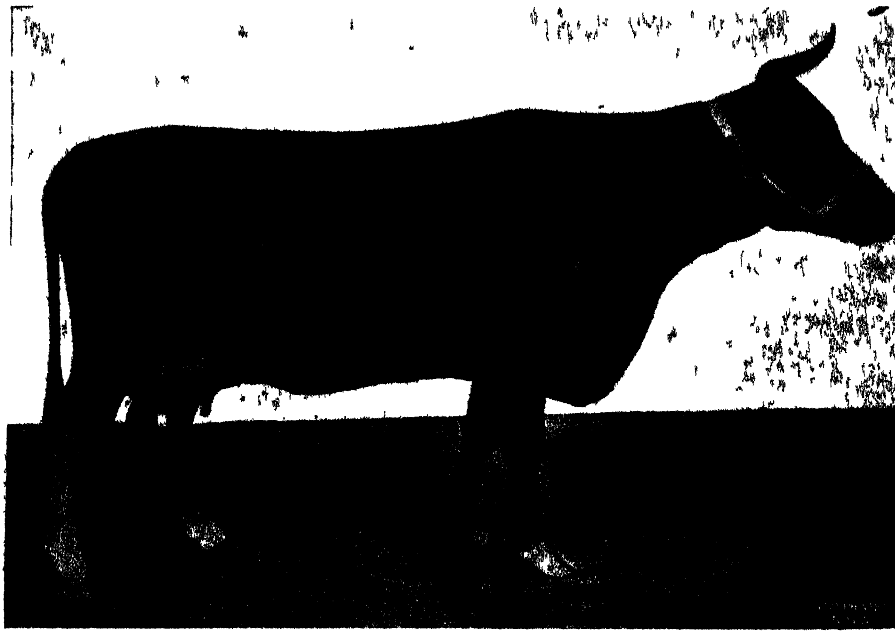
Brand	Waikouaiti
Quantity	140 crates
Ex S.S.	Maori
Arrived	16th February, 1902
Weights	Correct
Colour	Good
Flavour	Fair

General Remarks.—A nice silky curd, full quality, and developing a nutty flavour.

GOOD TYPES OF DAIRY CATTLE.

She gave on a two-day test an average of 57·5 lb. of milk in 24 hours, 177 days after having dropped her last calf. Her milk tested 3·49 per cent. butter fat in the morning, and 4·78 per cent. in the evening.

Dairymen on the Richmond River and elsewhere will recognise many Guernsey features in this cow. Records show that in former



South Devon Cow, Primrose.

Winner of Barham Challenge Cup, Spencer Cup and the Lord Mayor's Cup in the Milking Trials at the London Dairy Show

days the Guernsey breed was one of those which formed the foundation of the South Devon breed.—M. A. O'CALLAGHAN.

A Pedigree Shorthorn Dairy Cow, Rose 26th.

Winner of First Prize at the Tring Show in the Milking Trials for Cows exceeding 900 lb. live weight, giving 72 lb 6 oz. of milk in one day, two months after calving.

The Tapeworms of Australia.

N. A. COBB.

Introduction.

THIS notice of the Cestodes of Australia is sure to find its way, to a certain extent, into the hands of readers unfamiliar with the nature and anatomy of these worms. Their knowledge will be limited to a creepy conception of a horrible and disgusting flabby parasite of immense length inhabiting the human body, or that of some domestic animal. This conception, so far as it goes, does not depart far from the truth, but it is a very limited conception and one that might advantageously be enlarged. The following introductory paragraphs, without pretending to give a complete review of our knowledge of tapeworms, are intended to assist any reader who, with a desire to understand the subject, finds himself without a guide. At the same time, some portions may not be unworthy of the attention of such as already have some knowledge of the subject.

At the outset, let us give up the idea that tapeworms are in all aspects disgusting and undesirable objects of study. We must freely grant that their mode of life is disgusting to us, and that to the average person they are anything but agreeable to contemplate. Still, once removed from their habitation, and brought under examination by appropriate methods, they are anything but uninteresting, and when at last we begin to understand their remarkable structure, and above all their marvellous history, we are forced to concede them an interest of no ordinary sort.

Tapeworms are found in all sorts of vertebrate animals, in all parts of the world. The number of kinds at present known is not far from 500, but this is certainly only a small fraction of the species that actually exist. Sooner or later I have found the great majority of the species of vertebrates that have fallen particularly under my notice to be inhabited by one or more species of tapeworm, and I think those qualified to pass an opinion will bear me out in stating that in all probability the great majority of the vertebrate species are so infested. Now, as the number of species of vertebrates approaches 25,000, it seems quite clear that in the future we shall number the species of tapeworms by thousands instead of, as now, by hundreds.

In other words, the prevalence of tapeworms is far beyond any of our ordinary conceptions. Circling with the eagle, skimming, wheeling and diving with the swallow, leaping and cavorting with the dog, slowly crawling with the reptile, threading the deep with the fish, these worms experience every variety of habitat. Themselves without wings, legs, or fins, they yet penetrate to every region where wings, legs, or fins could carry them.

The collection and examination of tapeworms is beset with unusual difficulties. We have already said enough to indicate the distasteful

character of the work. To this we must add the hidden nature of the life of the various species, and the uncertain return from a vast amount of search. Join to these our natural aversion to the destruction of vertebrate life, and a formidable list of obstacles is already enumerated. If we omit the domesticated animals used as food, and the various pests, then we must say that on the average the collection of every species of tapeworm, and in not a few cases the collection of every individual worm, costs a life, always interesting, and often beautiful as well as useful. Small wonder that the progress of knowledge in this direction is slow!

Still, the fact that these worms inhabit man, and cause very serious diseases, both among mankind and among domesticated animals, has given rise to much research, the results of which are not inconsiderable.

The structure of the adult form of the tapeworm may be understood, to a certain extent, by a study of the accompanying diagram, in which an attempt has been made to picture, on a magnified scale, the various organs in such a way as to show their relation one to another. The illustration is not drawn from any particular species, and the proportions have been made somewhat unnatural, in order to show in one figure all the parts on a scale that would permit of clearness. Thus the head is drawn larger in proportion to the size of the body than is usual.

So far as mere nomenclature is concerned the figure explains itself, but it may be of some assistance to the novice if the interaction of the various organs is explained more fully.

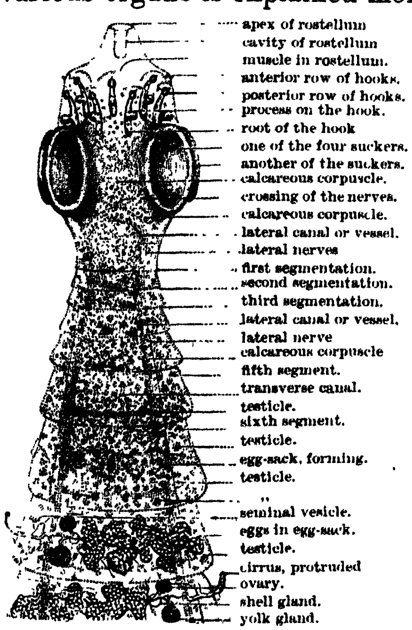


Fig. 1.—Diagram of a tapeworm, drawn on a magnified scale.

The (scolex) or "head" is purposely drawn too large in proportion to the size of the segments, in order to show in a single moderate sized illustration the relations among the various organs.

The tapeworm is not an animal in the ordinary sense of the word, but rather a colony of animals,—at least, each of the segments of which the "worm" is composed has a considerable degree of individuality. Each segment, or proglottid, as it is termed in technical parlance, has the power to reproduce the species, and in that sense has a high degree of individuality. Nevertheless, until a late stage in its existence each proglottid is dependent for its very life on its connection with its mates. The whole series of proglottids has, therefore, been likened to a colony. In this colony there is a certain amount of division of labour. The portion composing the head is specially organised to form an attachment to the interior wall of the intestine of the host, and for this purpose is supplied with very

special apparatus of considerable complexity and of an extraordinary degree of interest. It is to these organs of attachment that we will first turn our attention.

It will be noted that the diagram gives no hint of a mouth, and this is one of the most peculiar features of the tapeworm anatomy: there is neither mouth nor stomach. Consequently there is an absence of all the muscles and glands usually associated with these organs. This absence of certain important organs is surely a profound modification of the ordinary animal anatomy, and the highly-peculiar form, as well as the manner of life of the tapeworm, is closely associated with it. In the "head" of the worm, therefore, we seek for no traces of mouth, teeth, tongue, or other organs of mastication and deglutition, nor do we expect to find there any organs of taste or salivation.

In order to understand the far-reaching modification of the ordinary animal anatomy that obtains in these worms, it is only necessary to consider their habitation. They usually live in that particular part of the intestine where the food has become fully digested, though not yet absorbed, by the host-animal. It would be superfluous for an animal bathed with such a food-supply, namely, food in a state of complete digestion, to be supplied with organs of digestion. We find that the digestive system of the tapeworm begins at the point we should expect from the nature of its food. The worm is supplied with pores on the surface of all parts of its body through which its prepared food is absorbed.

In fact, if we regard the tapeworm as an ordinary animal organism turned inside out we shall possess ourselves of an idea fruitful in many ways. Physiologically they are in many respects literally inside out, and it is by no means certain that, morphologically considered, they suffer violence from being considered everted organisms.

It has been necessary to say all this in order to fully prepare the reader to approach the peculiar structure of the "head" of the tapeworm with a mind free from misleading preconceived notions.

The head, or scolex, as it is more properly called, of a tapeworm is primarily an apparatus for firmly attaching the worm to the intestine of its host with a minimum degree of harm to the host and a maximum degree of security to the parasite. It must be borne in mind that the very life of the tapeworm depends upon an exceedingly nice adjustment of circumstances—hangs by a thread, as it were. Its habitation is one beset on all sides by chemical conditions that would be fatal to its existence. Only in the duodenum, a limited tract of the intestine, can it as a rule secure food perfectly prepared for its requirements. Not only this; for, if by any chance it should lose its hold at an inopportune moment, it would be carried, by the chyle stream in which it more or less passively floats, to parts where the conditions are very different and inimical. These circumstances give to the structure of the tapeworm head a primary importance that has led to the development of elaborate structures which we will now attempt to describe with the aid of the diagram.

It is somewhat difficult to form an opinion as to the relative importance of the two sorts of apparatus by means of which the tapeworm

scolex is fastened to the inner wall of the intestine of its host. The sucking discs and the hooklets exist side by side in most of the species, at any rate in the younger stages. Inasmuch as the suckers are almost never absent, these will be taken first. As shown in the diagram, these suckers usually have the form of simple concave discs, and are four in number, though they are in some instances fewer. By appropriate muscles these cup-shaped discs can be made to produce a vacuum in the way familiar to us in a number of well-known rubber-disc toys, where the moistened disc is placed in contact with a flat surface, and then by a central string or radially elastic arrangement of the rubber itself a vacuum is created which causes the disc to hold fast to the surface. The sucker of the living animal is a vastly more complicated and efficient apparatus than that of the toy here used as an illustrative example, but the principle is the same in each case—a moist disc is placed in contact with the surface to be grasped, and then a vacuum is created under the disc, by the retraction of the central part of the disc only.

These discs are often so prominent in tapeworms as to give the scolex of the animal a quite distinctive appearance; on the other hand, well developed discs may be so small as to barely increase the diameter of the head over that of the neck. As a rule, the suckers are most perfectly developed in those cases where the hooklets are absent.

The hooklets are nearly always placed in front of the suckers, and are nearly always associated with the so-called rostellum. This latter is the most anterior of all the parts of the body, and usually consists of an extensible soft beak, supplied with muscular fibres in such a manner as to enable the worm to use it as a boring or penetrating organ. In this function it is perhaps assisted by appropriate secretions having a solvent action. The hooklets are arranged around, or even in, the rostellum, though, most frequently around it, and generally near its distal end. The hooklets are often of much the same form as the claws of a cat, and they can be put forth and withdrawn in much the same way as the cat's claws. As a rule, the hooklets are numerous, sometimes as many as two hundred, and are usually arranged in two circles around the longitudinal axis of the scolex, so that they point radially in all directions. The arrangement in two groups, or circlets, probably has something to do with the power to bore or tear deeper into the flesh of the victim. While one circlet is withdrawn the other may keep hold, and by this alternate action of first one group and then the other the head may be advanced deeper and deeper into the tissues—at least this is the writer's opinion, derived from observation. Sometimes the suckers are armed with small hooklets, either on the margin only, or all over.

It occasionally happens that, through the degeneration of the scolex, its functions are taken up by the proglottides immediately behind. Such a condition of things gives rise to a so-called pseudo-scolex. A pseudo-scolex is known by the absence of all the most characteristic structures of the scolex proper, *e.g.*, the hooklets, four suckers, and the "beak," as we may call the tip of the rostellum.

Here we leave the organs of the so-called head, though there are a number of interesting modifications that may come up for consideration later. In the head we have seen neither mouth nor organs of sense, and this constitutes, from the popular standpoint, one of the most

Fig. 2.—Pair of hands, posed to illustrate the supposed alternate action of the two rows of hooklets found in the rostellum of tapeworms. To assist in understanding the explanation given in the adjacent text.

remarkable peculiarities of these worms. It must be borne in mind, however, that the popular standpoint is one that is in no way endorsed by science, for the tapeworm has been shown, as before remarked, to be a colony rather than an individual, its elongated and worm-like form being a complete deception. From this it follows that the "head," as one of the members of the colony, is no more entitled to present to our view a mouth and organs of sense than any other member of the colony. Briefly, the so-called head is one of the members of the colony that is transformed into a special part adapted with the most wonderful perfection to securing a fast anchorage at the place best adapted to the welfare of the whole colony.

Throughout the colony are to be found imbedded in the tissue of the body walls small, more or less ellipsoidal corpuscles of lime. These are of microscopic size. Their office is not well understood. They are often numerous, especially near the head, but sometimes they are few or even almost lacking. They vary somewhat in form, and this fact, together with their relative frequency, has been utilised in distinguishing one species of tapeworm from another. They are usually termed the calcareous corpuscles, and they are illustrated under that name in the diagram. They are composed principally of carbonate of lime.

Though we are largely ignorant of the nature of the sense-organs of tapeworms, it is certain that they possess them, and it is not going too far to say that they are located more particularly in the "head" or scolex. One evidence of this exists in the fact that the nerves of the tapeworm colony converge here. There are main strands of nerves passing through the colony, as shown in the diagrams. These strands are usually more or less lateral, but in the hinder part of the scolex they join and cross, and from this junction extend forward toward the suckers and the hooklets, to whose muscles they are in part distributed.

Another organ originating in the hinder part of the head is the canal system connected with the excretory functions. For, although

the tapeworm may dispense with a digestive canal and digestive glands, on account of receiving its food in an already digested condition, it cannot dispense with special organs for getting rid of its excreta. These excreta are liquid in consistency, and are collected by minute canals that empty into the system of lateral canals pictured in the diagram. No attempt has been made to show the minute collecting canals or branchlets, as they are almost infinitesimally fine. The excretory fluid, having been collected by them and emptied into the larger canals, usually two on each side, is carried backward and emptied at the posterior extremity, *i.e.*, at the final segment.

Although the nerves and the excretory canals are thus connected in such a way as to be continuous throughout the length of the colony, we must, nevertheless, consider them as belonging in one sense primarily to the separate segments, and the connection as being kept up as a convenience in the division of labour in the colony. Each segment is a derivative, by a process of budding, as it is called, and ultimately it often happens that the mature segments become loosened from the colony and lead a separate existence for some length of time, when of course the nerves, muscles, canals, and so forth, function independently as if they had never had any connection with the rest of the colony.

The segments of which the "body" of the tapeworm is composed originate at the base of the scolex, where there is a more or less distinct portion called the "neck" of the worm. At this point there occurs a succession of intercalations, or buddings, each step in the series of buddings resulting in what in the end becomes a complete segment of the worm. At first these segments are so narrow and so little distinguishable one from another that it is with difficulty they are made out. As they are pushed back by the formation of newer segments, they grow and become more distinct. These features are well illustrated in the diagram. After a while the segments begin to present a more definite and elaborate organisation, which continues to increase in complexity until the maturity of the segment.

The living tapeworm is remarkable in that the extremes of form which it can assume are widely different. In its contracted condition it may be very short and thick, and show very little trace of segmentation on account of the segments being drawn closely together. On the other hand, when the same worm is outstretched it becomes long, thin, and slender. In some instances the outstretched state may be ten to twenty times as long as the contracted state. When contracted the segments may be much wider than long, yet when outstretched the same segments may be much longer than wide.

This power to vary the form within wide limits makes it very difficult to describe the different species in intelligible terms, if we confine ourselves to the dimensions of the whole colony or to those of the separate segments. We are obliged to content ourselves with measuring the average dimensions and the extremes.

The mobility we have just described is due to the action of muscular fibres, which are repeated in each segment. From the slowness of the motions we should judge that the musculature is not

strongly developed, and in this judgment we should be entirely correct; for when we come to dissect or section a segment we often find that in proportion to its size it is much less muscular than is the case with free-living organisms of the same size.

The muscular system consists of fibres passing in various directions through the segment. Longitudinal fibres and transverse fibres predominate, and this harmonises with the motions we have already noted. The longitudinal fibres serve, by their contraction, to decrease the length of the segment and hence to increase its thickness. The transverse fibres, which may be observed passing from side to side, serve to cause the walls to approach each other and hence to increase the length of the segment. Other muscles exist, but these two antagonising sets of fibres are the main features of the muscular system.

The muscles are so associated with the nervous system that in action the muscular impulse is seen to pass in waves from the scolex toward the posterior extremity in regular order, at least this phenomenon is a familiar sight in worms when first removed from their recently-killed hosts. We may, therefore, figure to ourselves the nature of the movements of the parasite when the host is alive as being also of this sort. It is worthy of notice that the muscular movements of the intestine of the host are of a similar character, *i.e.*, consist of a series of waves, the so-called peristaltic movements. It is possible that the movements of the parasite are made to precisely counteract the peristaltic movements of the intestine. This peristaltic movement would tend, of course, to force the parasite onward in the intestine to a place less adapted to its requirements. It is noteworthy that the rates of these two motions are about the same.

As the segments ripen they evolve not only a more complete musculature but develop in other ways. The rapidity with which this takes place varies in the different species. Some species are of great length, and the segments do not become mature until after the lapse of weeks or months. In other cases the worms are short, consisting in some instances of only three or four segments.

As the segments grow, they change in character in a remarkable manner, becoming sexually mature in different ways at different dates. Each segment first ripens its male sexual products, and afterwards its female products, so that the same segment may be at one time essentially male, and at another essentially female. This characteristic fact is illustrated in the diagram, where the fifth and sixth segments are represented as male and the succeeding ones as female. It of course follows that a colony may be at one and the same time male in one part and female in another.

An examination of the diagram will show, scattered pretty uniformly through the male segments, small groups of dots representing the testicles. These are very numerous, and each group of testicular cells becomes connected, by means of a minute duct, with a common canal through which the spermatozoa are sent to the receptacle in which they are stored preparatory to the act of fertilisation. This receptacle is shown in the left hand side of the fifth segment of the diagram.

The act of fertilisation is accomplished by the insertion into an opening in the same or another segment of the organ known as the cirrhus. This is a sack or tube capable of being turned inside out or everted; when thus utilised it becomes a protruded tube connected with the stored-up seminal product, and through it the latter is conveyed to the interior of the vagina, usually to a particular portion of it, which thus becomes "fertilised." The copulation takes place between segments of separate worms, or between the different segments of the same colony, or even between the elements of the same segment.

When a segment has emptied itself of its male product it proceeds to develop its female elements; and it is with this development that the segment assumes its largest growth. The production of the eggs is accomplished by a sort of threefold arrangement. Each of the three operations is represented by a distinct apparatus. The egg nuclei are the product of a double or single distinct organ, the ovary; they are supplied with food material from a separate gland (or glands), the yolk gland, and finally, the nucleus and the yolk are enclosed in a shell, the substance of which is secreted in a separate shell-gland.

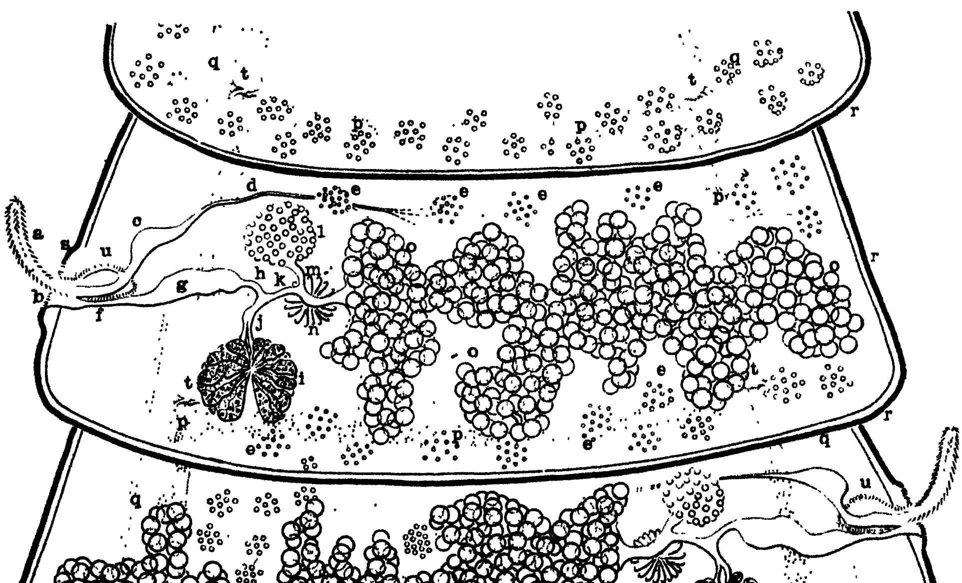


Fig. 3.—Enlarged diagrammatic figure of segments 6, 7, and 8 shown in Fig. 1., designed to show in greater detail the anatomy of the ripening and ripe segments of a tapeworm.

a, the cirrhus, protruded.
b, sexual atrium.
c, seminal vesicle.
d, vas deferens.
e, e, e, e, testicles.
f, vagina.
g, seminal receptacle
h, seminal duct.
i, two-lobed ovary.
j, ovarian tubes.
k, fertilising canal.
l, yolk-gland.
m, yolk duct.
n, shell-gland.
o, o, o, o, eggs in the compound uterus.
p, p, p, p, one pair of the lateral vessels and their transverse connections.
q, q, q, q, one of the two pairs of main longitudinal nerves.
r r, r, cuticle.
s, sexual pore of which "b" is the atrium.
t, t, t, t. valves in the lateral vessels.
u, cirrhus pouch.

After passing through their various stages the eggs, often produced in thousands in a single segment, are moved onward into an egg-sack or uterus. In form this may be either simple or more or less ramified.

The various stages in the formation of the egg-sack are shown in the diagram in segments six, seven, and eight. In the seventh segment it has already assumed a moderate degree of complexity. The arrangement of the sexual orifices or pores and the form of the egg-sack are used as characters for the separation of the species into groups of a higher class.

The eggs are usually spherical or subspherical, though sometimes they are ellipsoidal or even elongated.. In the various species they vary in size, but within rather narrow limits. The shell is usually thin and transparent, so that the embryo may be seen through it with a good degree of plainness. In many genera the embryo is well developed at the time the ripe segments separate from the remainder of the colony. Its character is fairly constant throughout the various genera, being that of a subspherical organism supplied with six hooklets on one side, so arranged as to serve the purpose of boring or digging. The egg-shell sometimes presents a distinct lid which facilitates the escape of the embryo.

As it has been found that the male elements of the proglottid are more particularly assembled toward one of the broad faces of the proglottid, and the female elements toward the opposite face, the custom has grown up of naming these faces—partly at least on account of this difference—the one dorsal and the other ventral. The male face is regarded as dorsal, while the female face is regarded as ventral.

Inasmuch as there are species that it is impossible to orientate on this basis, there are notable objections to this nomenclature, but on the whole it has proved useful.

To Collect Tapeworms.

It may not be out of place to note down a few of the methods found useful in the collection and preservation of tapeworms, for, as before remarked, the assembling of the material for the study of these animals is beset with peculiar difficulties.

The greatest difficulty is the time-consuming nature of the work of collecting, especially that part connected with the cystic forms found imbedded in the tissues of the intermediate hosts. These cysts are often very small in size, and they do not reveal their location by any movements or by any very striking peculiarity. We must add to these difficulties the fact that the internal anatomy of the intermediate host may itself be so little known that considerable time must be spent in its study in order to be able to pass judgment as to the normality or otherwise of the appearances met with. The difficulties in this respect are so very great that this portion of the life history of tapeworms remains to-day to a very large extent unknown. Very few of the hundreds of known species have their life histories worked out; the rest are known to us only in their sexually mature form or generation, in spite of the fact that they are so often the cause of disease and loss of life to man or to his domesticated animals.

Nor are the difficulties connected with the study of the larger forms found in the intestines of vertebrates much less. The mere search for material is girt with obstacles. Life must be sacrificed for almost every specimen. Time—almost without limit, I had nearly said—must

be given to the patient searching of entrails, often without reward. We have little to guide us as to the best time at which to search, and are as likely as not to conduct our search at the wrong time of year, or at a time when there is no "epidemic," or maximum of material. Of course these remarks do not apply to our domesticated animals, or to man, so far as the sexual generation of the tapeworms is concerned, but unfortunately they apply with the fullest force to the intermediate forms. For, without exception, each of the tapeworms causing epidemics among ourselves or our flocks has its intermediate form, just as important as the sexual form, or even more so, in some wild species, the clue to which is of the blindest nature. So varied are the intermediate hosts of the various tapeworms, that one is justified in looking for them in almost any wild species. The only clue we have, is the fact that in all probability the intermediate host will be found to be one that in some way or other, either as food or by accident, can gain access to the alimentary canal of the afflicted man or beast. We thus have to consider not only the normal food, but the multitude of accidents by which material not strictly food can gain access. We have to consider not only the wide range of food of the dog, for instance, but also the fleas and lice and other external parasites which he removes from his skin with the aid of his teeth and tongue. We have also to consider the parasites of all the animals he may prey upon. Add to these an investigation of the sources of his supply of natural water, and the numerous accidents of which we at present have no means to so much as conceive, and it will be at once evident that the whole matter is beset, as we have said before, with an unusual degree of difficulty. We cannot wonder that even to-day, after generations of research, we remain in complete ignorance as to the source of infection in the case of some of the commonest and most injurious tapeworms.

Therefore he who sets out to discover the intermediate host of even a single species of tapeworm has before him a problem of noble proportions. To begin with, he will have use for all the arts and tricks of trade of the hunter and trapper and scientific collector. To be fully equipped he should bring to his aid an intimate knowledge of the anatomy of all the zoological orders in all the various phases of their existence! To these qualifications he should add a knowledge of the methods of preservation and examination peculiar to this class of organisms.

It is entirely out of the question to enter upon the problems raised by the variety of animals to be captured, but we ought to devote a few sentences to the methods of fixing and preserving the worms when once they have been found. Such information may be of use to the growing class of observant people who make it a rule to preserve for the benefit of science such specimens as come within their reach.

The intestine to be searched should be placed on a board and there held in position by pins or pegs. It should be outstretched, or if it is of great length should be turned back and forth. The search should be conducted as soon after death as possible. The intestine is to be opened from end to end by cutting longitudinally, either with a

sharp knife or scissors, preferably the latter. The point of the knife or scissors should be blunt, though only slightly so, and the cutting should be done with a lifting motion, so as to avoid cutting the worms that may possibly be present in the intestine. This is a matter to which a good deal of attention should be given, as it is highly disappointing after taking, it may be, the very greatest trouble to secure specimens for examination to inadvertently cut the parasites into several pieces. The scissors point that is working on the inside of the intestine should be made to travel in close contact with the inner wall of the intestine with just so much pressure as will avail to secure that object with certainty. This amount of force will as a rule raise the intestine a little from the board and stretch it a little.

The cutting should begin at the stomach and extend to the anus, and branch off into the liver, &c. When present, the tapeworms are usually found to be attached near the stomach in the duodenum, but fragments naturally loosened may be found anywhere in the intestine, and after the death of the host the worms that during life were in the duodenum may have wandered elsewhere. If the dissection takes place immediately after death, the bulk of the specimens are almost sure to be found in the duodenum; but this fact does not obviate a search throughout the alimentary tract.

After the intestine has been slit open it should be laid out flat, so as to disclose the whole of the interior surface. If the worms are large they will be at once visible in the chyle, where they are all the more easily seen on account of their movements,—that is, if the dissection has taken place immediately after death.

If the worms are small or are young, they may be completely hidden in the contents of the intestine. It is therefore necessary to wash the interior wall quite clean, in order to discover these small forms. The proper fluid to use for this purpose is some indifferent slightly alkaline liquid. A one per cent. salt solution may be used.

When the worms are found, the head of each should be located and an effort made to gently loosen its hold without breaking the neck. If the hold cannot be thus loosened, a small portion of the intestine may be removed with the head.

If it is desired to study the worms alive, and it should always be the aim to make such a study as soon as possible, they may be placed in water to which white of egg has been added. If the host is a cold-blooded animal, no further precaution need be taken than to add to some water some white of egg in small quantity, and a little less than one per cent. of salt. If the host is a warm-blooded animal it becomes necessary to produce the normal temperature by artificial means, and some sort of an incubator becomes useful. These studies on the living parasite are most important, and lead to results not obtainable by any other means.

There is a method of removing tapeworms from an intestine practised by the late Dr. Thomas, of Adelaide, that deserves mention. It consists in passing fluid *through* the intestine, which, for this purpose, must be as nearly intact as possible. A nozzle is so attached to the anterior end of the intestine that the fluid delivered through it will have to traverse the whole length of the intestinal tube. If the

fluid be of the right nature, and be applied in the proper manner, the tapeworms will eventually be washed loose, and may be then collected in proper receptacles, which, according to my experience, should include sieves having a mesh no more than $\frac{1}{3}$ of a millimetre across. With long-continued washing, this method is one that is particularly adapted to the collection and counting of such small and dangerous tapeworms as *T. echinococcus* of the dog.

After the intestine has been washed for a long time, so that all the parasites have been removed, the collected material is fixed with corrosive sublimate and examined. This method is not well adapted to the securing of the best specimens for anatomical and histological examination, but is quite suitable to estimating the degree of infestation, and in this respect was most useful to Dr. Thomas.

Preservation.

As to the means of fixation and preservation comparatively little has been written, and the number of ways tried appears to be small. I will first describe that from which I have had most satisfaction.

When the worms have been removed and washed in a neutral fluid, they are laid out on a smooth wet board or plate of glass, and a neutral fluid poured over them so as to wash them out straight. Then with two soft camel-hair brushes they are stretched out by brushing them each way from near the middle. This is usually necessary on account of the tendency of the worms to contract as soon as removed from their habitat. It is on this account that many of the specimens to be met with in museums are in an exaggerated condition of contraction which as a rule interferes with a convenient examination of the details of the anatomy.

When the specimens have been arranged in a position that is suitable for the after-examination, they are at once fixed. This is done by pouring over them from the head toward the posterior extremity the fixing fluid, which is preferably one of those that act rapidly, and, if possible, its action should be hastened by heat. I find that a concentrated solution of corrosive sublimate at a temperature of upwards of 100 degrees Fahrenheit acts promptly, and that the fixation is good. I always provide, if possible, a large quantity of the warm solution and keep pouring it over the specimens until the outward fixation is complete. The specimens are then removed to some of the same solution in a dish. I never allow the solution to become hotter than about 140 degrees Fahrenheit. The specimens remain in this hot solution until thoroughly fixed, often an hour or more. I am the more particular to use heat because the shells of the eggs are peculiarly impenetrable, and I like to secure in them a sort of fixation due to heat, even if the fixing fluid does not actually penetrate them.

I have had little experience of any other fixation than that just described, but what little I have had with picric acid in its various combinations leads me to think well of it.

When the fixation is complete, transfer to gradually-increasing strengths of alcohol until 70 per cent. alcohol is reached. They may remain indefinitely in this, and are ready at any time for such further operations as may be necessary.

If it is desired to carefully study species that have considerable thickness, it may be best to flatten some of the segments between two equal pieces of glass. This can be accomplished in a simple manner by placing living segments between the pieces of glass, and then winding the whole around with thread until the necessary thinness is imparted to the segments by the gradually-increasing pressure. When the thread is tied the pieces of glass are immersed for some time in hot sublimate solution. In this case it is necessary to keep the specimens in the fixation solution for a longer time than would ordinarily be the case, as the fluid penetrates slowly between the glasses. The segments sometimes trouble by sticking to the glass when the thread is unwound. This may be obviated by having the glass very clean to begin with and then smearing it with vaseline just before using. A rapid fixation may be secured by hot sublimate, which attacks only the edges, chemically speaking, but by its heat fixes the remaining parts. As soon as this marginal fixation is accomplished, the glasses are untied and the flattened segments placed in sublimate to complete the chemical fixation.

For examination without staining, carbolic acid dissolved in alcohol may be used as a mounting fluid to supplement what can be seen without its aid. This will usually so clear the head that the hooklets can be seen and counted, and it is also of use in examining the eggs, &c.

It is also of use in examining the segments—for instance, in the numerous cases where it is not possible, in the ordinary course, to see the location of the sexual pore. Again, it is of use in the examination of the cysts, where it renders prompt service in revealing the form and position of the heads or scolices.

I find that much more can be found out about the internal structure of the segments by actual dissection than seems to have been hitherto imagined. If the segments be cut in two and then be pinned to black wax with very fine pins made for the purpose from the finest mandolin wire, and placed in sunlight under a high-power dissecting lens, a pair of sharp needles may be made to reveal a vast amount of detail hitherto considered undiscoverable except through the use of the microtome.

History.

Roughly speaking, the origin of the tapeworm head or scolex may be described somewhat as follows :—After the larva has escaped from the egg and has gained access to the stomach of its secondary host, bored its way through the wall of the alimentary canal and found its way into the blood stream, it settles in some congenial place to undergo its metamorphosis. It soon develops into a sack-shaped preliminary stage by changes usually involving considerable growth. By an invagination of the wall of this sack a peripheral cavity is formed in which the head of the future tapeworm next appears; sometimes from a small budding at the bottom or inmost part of the cavity, sometimes by a more general method of a similar nature, the head grows with its hooklets and suckers complete.

The continuance of each species of tapeworm depends upon a variety of factors of the greatest interest, more especially as upon a

knowledge of some of them depends the nature of the measures adopted by man for his own benefit and protection.

Most of the species rely upon the number of their eggs and the manner of their distribution for the continuance of the species, rather than on a definite effort to actively reach the particular intermediate host. In some cases the eggs hatch in water, and the larvæ become covered with cilia that aid them in swimming and locating themselves advantageously. All the species that follow this line of development are characterised by a smaller number of eggs than is the case with those species in which the migration to the new host is a passive one. We see here a most instructive case of that saving of energy, or the reverse, according to a particular mode of life, which becomes so prominent among parasites. If the method is uncertain and passive, the number of eggs produced is correspondingly increased. If the method includes a certain amount of initiative the number of eggs becomes reduced in proportion to the increased certainty of the survival of any particular larva.

From this we gain some ideas that are of use in speculating upon the probable life histories of the various species, and this is a matter of some consequence when, as at present, we know the life history of so few. If the number of eggs is low, we may at once suspect a life history involving few chances of miscarriage, and direct our speculations accordingly. On the other hand, if the number of eggs is very high we may feel certain that the migration to the intermediate host is a passive one and is beset with many chances of mishap.

Associated with these ideas are those facts of growth and maturity that tend in the same direction. If we stop to think which method will be best suited to the continuance of the species—a sudden and uniform ripening of the proglottides, or a ripening slow and long drawn out—we shall not be long in coming to the conclusion that when the segments are ripened one at a time and shed singly through a lengthened period, the chances of the survival of the species are much increased. Under such circumstances the excreta of the host will have been deposited in the greatest number of places and under the greatest number of different conditions. This, of course, under the laws of chance, gives the greatest probability that some of the eggs will meet with that particular combination of conditions that will lead to a successful consummation.

I know of no instance of *Taeniasis* in a wild species, but our domesticated animals are kept under conditions of such a nature that cases of epidemic disease connected with tapeworms are not at all uncommon. More of this anon.

The number of tapeworms found in one individual host varies within wide limits. As a rule, the number is a limited one: from one to half a dozen. In some instances, however, the number rises to hundreds or even thousands. It is astonishing how many parasites of this sort a wild animal or bird will sometimes harbour without appearing to be inconvenienced. This may be a deception, for we must remember what very poor judges we are of the habits and manners of these wild animals. We are, for the most part, quite unable to tell one individual

among them from another, and hence any consecutive observation is impossible unless the circumstances be special and exceptional. If we were able to distinguish symptoms of ill-health among them as we are among ourselves, it is possible that we should hold a different view. Be that as it may, it does not dissipate our astonishment at finding, as we sometimes do, a good fraction of the weight of the host to be due to its parasitic tapeworms. I have seen specimens of the little Grebe —a bird not much larger than a pigeon—of which at least one-tenth of the live weight was composed of tapeworms, and yet the bird appeared to me to be in the most perfect health. It is not beyond the bounds of possibility that these worms may be beneficial to their hosts in some way, but if this is so it has yet to be proved.

Fortunately, scientific studies have so completely elucidated the life history of most of the tapeworms inhabiting man himself as to afford clues as to preventive and remedial measures of a very effective nature. In some instances we are still in the dark, but these are in a minority. It is otherwise with most of the tapeworms of the domesticated animals, for we are still in profound ignorance of the history of the eggs and all the intermediate stages. In many cases we only know the adult or sexual stage of the worms. In a general way it may be said that most of the species inhabiting man obtain access to his body through the eating of insufficiently cooked meat or fish, the intermediate forms of the worms being denizens of the flesh of animals or fishes used as human food. There are, however, most important exceptions to this rule. One of the most important of these exceptions arises from the fact that man is the intermediate host of some tapeworms that reach maturity in the intestines of other animals. As we shall presently see, the complete history of every tapeworm involves two hosts, one of which is, as a rule, accustomed to feed upon the other. As civilised man is no longer, or at least only rarely, the food of any wild beast, it would seem that any tapeworm life history involving man as an intermediate host would be out of the question. Unfortunately, we are the heirs of a different order of things, for in the remote past, when man had not so completely armed himself against wild beasts, he was not infrequently a victim to their rapacity, and in those times the flesh of human beings was a normal food of a number of wild animals—as, indeed, it is to-day in certain parts of India where man-eating tigers still exist. It therefore happens that man still becomes infested with the intermediate forms of tapeworms inhabiting these beasts of prey. Of these species, that which most interests us in this country is the minute tapeworm of the dog and wolf tribe, whose intermediate form is found in many of the animals upon which that tribe now feeds or has fed in the remote past, including man. This tapeworm is very common in this country for the reason that the intermediate form, known as a hydatid, is very common in the sheep, and is constantly being transmitted to dogs. This close association of sheep and dogs is considered indispensable by many engaged in the industry of sheep-raising, and it seems impossible to interfere with conditions so firmly established—at least that is a common view entertained by those who have studied the subject.

Now, the transmission to man in this case has nothing to do with any food that he eats. The worms, occurring as they often do in thousands in the intestine of the dog, are enormously productive of eggs, which, being microscopic in size, are sure to escape from the excrement of the dog and to become widely distributed in the neighborhood of his haunts. Nobody in the vicinity is absolutely safe from them. If by any chance one of these microscopic eggs gains admittance to the intestine of man, the resulting larva bores its way into some blood vessel, and in the blood-stream is carried to some suitable part of the body—most often the lungs or liver—and there forms the dangerous growth know as a hydatid.

Hydatids are very common in Australia; in fact, the country is notorious in this respect, for there are few parts of the world that approach it in the percentage of cases of this sort. A large percentage of the sheep slaughtered are found to be infested; in fact, it is the rule in some parts of the country, rather than the exception, to find the lungs or other parts of the sheep to be infested with hydatids. This statement would not be true of lambs, but would be true, according to my observations, of sheep two years old and upwards. Other stock are infested in a similar way, and so, most unfortunately, is man himself.

It is believed that man is most frequently infested in some such way as the following:—The infested dog (a favourite one very likely), in the course of its toilet, lapping in the vicinity of the anus, becomes contaminated about the mouth with the eggs of its own tapeworm. These eggs are perfectly harmless to the dog himself, but it is far otherwise with his master, for let one of these eggs gain admission to his body in a living condition and the result will, in the natural course of events, be the production somewhere in his body of a hydatid cyst. How could the egg gain admittance? The imaginative reader will already have surmised half a dozen ways. The dog in a fit of affection laps his master's hand, and transfers the egg to the caressed part (ironical event!), from whence it is carried to the mouth. Or it may be that the dog is fed from a family plate, and the plate is carelessly cleansed before being again used at the family dinner table, and from the plate the egg is transferred to the unsuspecting victim. These occurrences—and we have only suggested two out of many possibilities—must be common in this country, especially on the sheep stations. Of course, these eggs which give rise in the human body to hydatids are far too small to be seen with the naked eye, and from this it follows that no one has ever seen infection take place; but the experimental evidence in its favour is so complete that it would be madness to ignore the danger, just as it would in the case of smallpox and other diseases, transmitted no one ever knows precisely how in any particular case.

It would be an incomplete statement of this important matter that did not call attention to certain obvious precautions that will lead to a diminution of this and similar tapeworm diseases. This matter is dealt with in connection with the various tapeworms described in the course of these articles.

(*To be continued.*)

The Settlers' Guide.

(Continued from p. 53.)

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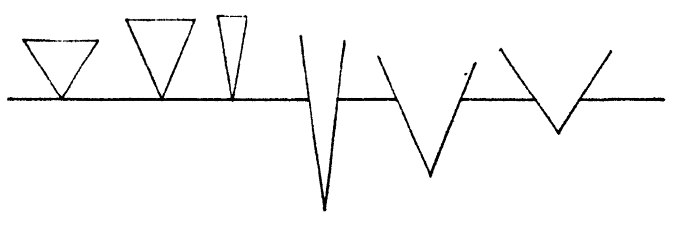
TOOLS.

THIS in an axe is technically called a thick shoulder. In diagram B, we see an edge with a still thicker and shorter shoulder or bevel. We can readily understand from this that the angle of resistance is nearly parallel with the surface to be entered, which makes it almost impossible for the tool to enter past the edge. In C we have a very different state of affairs. Here we see that the line of resistance is well towards being at right angles to the surface to be entered, consequently we can readily understand that this edge will enter the



B

Fig. 31.

wood easily for some distance before the top of the bevel strikes the wood. To put it briefly, in Fig. 31, are the lines of entrance. B is the log. The lines are all the same length, but when set at different bevels, the amount of entering power is good in the first, with its long bevel, poor in the second, with its thick bevel, and almost nothing in the third, with its very thick bevel. Thus it would seem that the nearer we can approach the right angle, with almost no bevel at all, the better our edge tools will enter or cut. Speaking practically, however, this statement must be modified. To get the best results with our perfect bevel, we must modify it (1) according to the quality of steel in the tool; (2) according to the hardness or softness of the wood to be worked.

Taking the first, remember that in the remarks on iron and steel, in the opening chapter, we said that the crucible steel was the best. We also said that steel, like iron, consisted of long strings or fibres of metal inlocked one into the other. Now, in crucible steel, these fibres are much stronger and more elastic than in a cheaper steel; consequently, we find that the better the steel the thinner we can have the tool, and, as a result, the longer we can have the bevel and the nearer to a right angle. The longer the bevel, the easier the work,

and the more we can get through in the day. But we must not ignore the temper of the steel either; it is just as important as the quality; if tempered too hard it will be brittle, and fly, or gap out; if too soft, it will bend and turn away from the surface when struck on it. Thus to get the best results, we must have a long thin bevel; to have this bevel usable, the tool must be of the best steel, properly tempered.

Now to the second point. We say that our bevel must vary according to the hardness or softness of the wood to be worked. Why? Because in an axe the cutting edge simply consists of the middle layer of fibres in the blade, next to them is the next layer, a little further back, and so on right through. See Figs. 22 and 23.

Thus we can see that the edge only keeps sharp because the layer of fibres lying next to it overlies it and prevents it from breaking away by lending it part of its elasticity. The third layer does to the second, and so on right through. Now, if the fibres of the wood to be chopped are very hard, the jar to the edge, or resistance in coming on them, will be great. Thus we can see that more elasticity will be needed than if cutting soft-fibred timber, with but little resistance, hence the second line of fibres must be closer to the edge to lend more. It follows then, that in grinding our axes we must again exercise that hard sense, miscalled common, and must grind our bevels both according to the temper and quality of the axe and also to the hardness or softness of the timber to be worked. The harder the timber the shorter the bevel, the softer the timber the longer, in reason.

These facts, and the "why" of them clearly understood, we will have no trouble in knowing what bevel to give our tools to get the best results. Now for the actual grinding, as theory is no earthly good without practice, and much practice makes perfect.

To Grind an Axe.—Hold it as shown, and keep the edge at right angles to the stone; travel the blade up or down a little when grinding the corners. Always turn the stone towards the edge; this applies to all edge tools. For two reasons: turning from the edge it will always grind a round coarse bevel; (2) the points of the fibres are left much more loose and open, thus giving much less elasticity than when compacted together as they are by the stone turning to them. Never grind dry; it heats the steel thereby, as shown before, taking the temper out of it. Never grind in the centre of the stone,

Fig. 32.

as so many do, with the edge parallel to the stone, as it spoils the stone for grinding any other tools, and twists the fibres of the steel at right angles to their proper cutting angle. Always give the edge and blade (not the eye) a dip in water after grinding; this washes off the little specks of grit that are clinging to it after grinding. The blade clean, now take a slip, oilstone, or axe-stone, and gently rub straight across the bevel, and then up and down, to rub off any wire edge and to inlock the edge fibres. Make the first rubs the hardest, and the last the lightest. The practice so common of giving the edge a few light turns on the grindstone, parallel to the stone, to rub off the wire edge and save rubbing on the finer stone, is a bad one, even when the stone is a very fine grit, as it disturbs the edge-fibres, and roughens them up into little saw-teeth, which soon chew off in use. Never leave the axe stuck in a green tree, as the sap-acid softens the steel and spoils the edge. Always keep a slip or axe-stone in a pouch on the belt, when constantly chopping, as some timbers will roughen the edge of any ordinary axe. On finding this, take out your stone, spit on it, and gently give the edge a few rubs, which will inlock the fibres again.

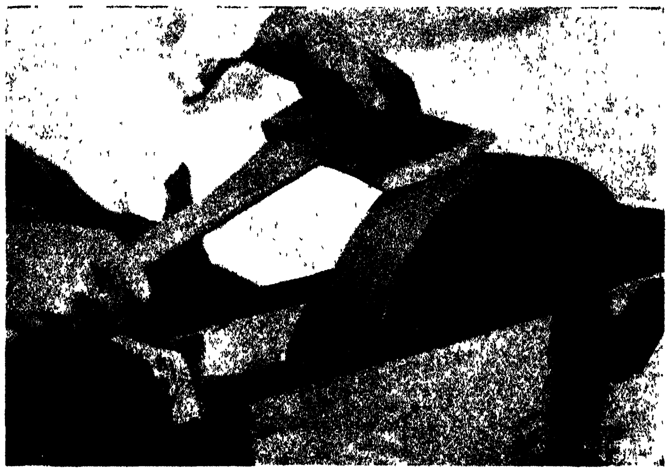


Fig. 33.

In conclusion, remember these points about an axe, that make for perfection :—

Never buy a cheap one; always one of a reliable brand.

See it is properly balanced.

See if it is a welded one, that the steel is dovetailed in, and not lapped.

See that the weight, shape of blade, and bevel are suited to the work it is to do.

If good steel badly tempered, send it to a good man and have it put right.

See that the poll is smooth; if burred, grind straight.

If badly handled, trim to suit, or if of bad grain, put in a new one of proper grain.

Be careful to grind and rub up properly.

Never leave the axe out in the weather, or in a green tree.

Points for loss of time, energy, and temper.

Always take the first axe the shopman offers you; do not waste valuable minutes picking a good one.

Never mind about the brand, balance, handle, or shape, as long as it is cheap; the cheapest must be the best.

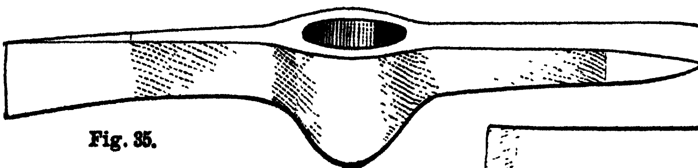


Fig. 35.

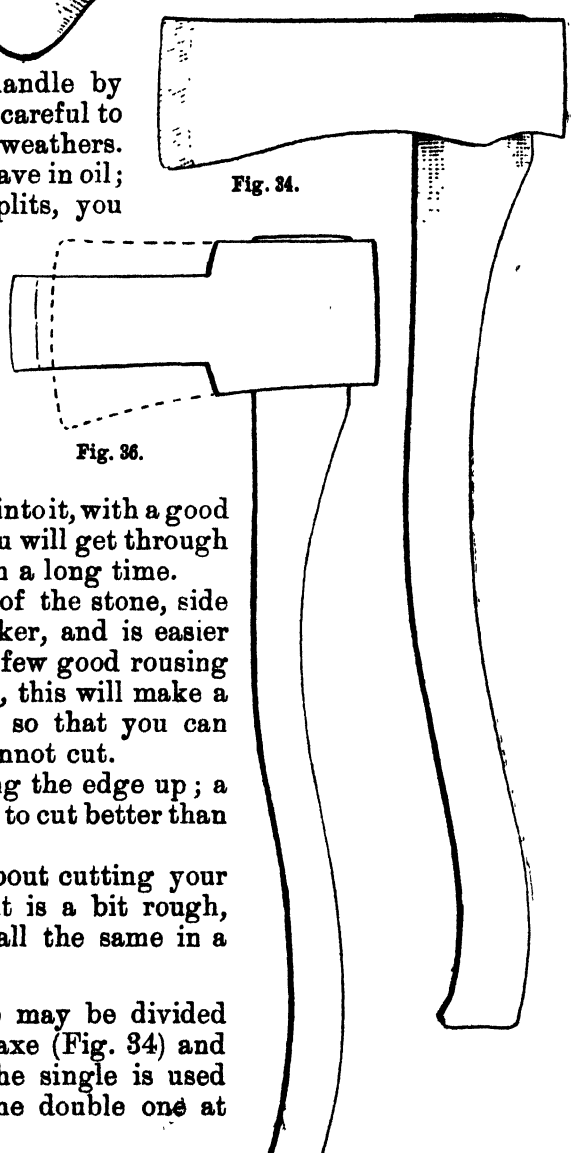


Fig. 34.

Fig. 36.

Never pamper the handle by oiling it, and be careful to leave it out in all weathers. Look what you save in oil; besides, as it splits, you can bind it with copper wire and tacks; this will make your hands hardy later on.

It is all rot about the bevel; when chopping, just bullock straight into it, with a good thick edge. You will get through a lot of work—in a long time.

Grind in the centre of the stone, side on; it cuts quicker, and is easier to hold. Give a few good rousing turns at the last, this will make a fine rough edge, so that you can saw what you cannot cut.

Do not bother rubbing the edge up; a rough edge ought to cut better than a smooth one.

It is all foolishness about cutting your work clean; if it is a bit rough, well, it will be all the same in a hundred years.

Mortising Axes.—These may be divided into two sorts, the single axe (Fig. 34) and the double (Fig. 35). The single is used parallel to the post, andthe double one at right angles to it.

The first one may be divided into three parts, the blade, the eye, and the poll. The most important part is the blade, the eye and poll being of little importance.

Of these single axes there are again two sorts, the wedge-shaped axe (the true mortising axe, Fig. 34) and the axe-eyed one, which is simply an old chopping axe, with a wedge-shaped piece of steel welded on the face, near the eye (Fig. 36). Of these two, no good fencer will use the chopping-axe sort, as they have neither balance nor length, and the edge will not stand in hardwood; they are too short to go through a big post. For small posts in soft timber, they are right enough; but no man doing much fencing would be bothered with them. A new chum can chop straighter with them, that is their only advantage.

The true single mortising axe is about 11 inches by 1½ inches wide in the blade. It should be of the very best steel, hand-forged. The shop mortising axes (Fig. 37) are of little use; after the first hour's use, usually a blue haze hangs round the head of the user, smelling of sulphur. This is only the mortiser expressing his opinion of shop axes in general, and this one in particular. They are cheap and awful; the smith-forged one, if properly made, costs from two to three times the amount, but, with proper care, will last a lifetime. At the present time, there are few smiths who can make tools properly, as the rush now is on cheap and nasty ones, and there is no encouragement for a good man. The best maker of tools I ever saw was a blacksmith named Clark, on the Parramatta-road, near Stanmore. His work went all over the colony; but alas, he is dead now, and has left no successor. No matter how good with steel and iron a smith may be, unless he knows how the tool works, he cannot make it the right shape and balance; that was where Clark shone, and where most of the present-day smiths fail. There is an opening in this State for a successor to Clark; but to be successful, he would need to spend a couple of years in the bush using the tools to get the "why" of them.

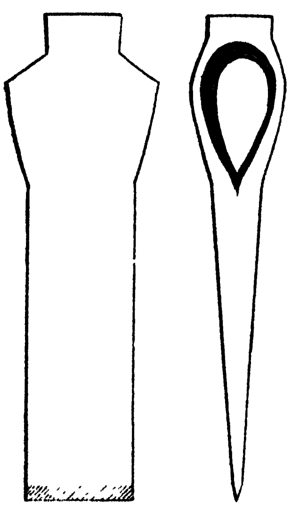


Fig. 37.

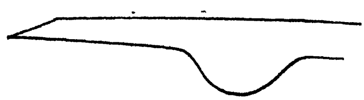
The edge of a mortising axe cuts like a chopping axe; it should be sharpened in a similar manner, remembering to shape the bevel according to the timber to be mortised. The handle is important; some fencers use a straight handle, but I prefer the handle shown (Fig. 38), as it lessens the jar very much. It is made from a pattern given me by a good old fencer, who would use no other.

Fig. 38.

The double axe, as shown, is to be preferred to any of the single axes, as there is little or no jar with it, and it cuts a little quicker.

It should be longer in the hoe end than the axe end, because that hoe end is the one that does all the work; the axe end being only used for trimming the hole. Also, it will fall better when longer at the hoe end, as it is then not liable to twist in falling. If the axe end is the heaviest, the handle has a tendency to twist, owing to the axe end wanting to fall first. This makes the blow lose its force, as the "drive" of the axe is sideways instead of straight down. The eye of the double axe should be large and tapered, so as to allow of a fair-sized handle; a thin handle is trying to use.

The proper weight of any mortising axe depends on the strength of the user. Some men can work best with a light axe, others a heavy one. From six to eight pounds is about the best. The hoe point is made both chisel and bar shape; I prefer the chisel shape myself, because it chops straighter.



Wedge or Splitting Axes.—These are of the two shapes. The first is a very useful axe for small timber, backing off the heart-wood or chopping woolly grain across when the log is split. It is sometimes used for mortising, but its wideness (3½ inches) unfits it for anything but soft timber.

The second shape is only used for big logs, where it is very useful. Some splitters use a bar sharpened instead of it. It is made similar to a single mortising axe, but about twice the length. Both these axes require very strong handles.

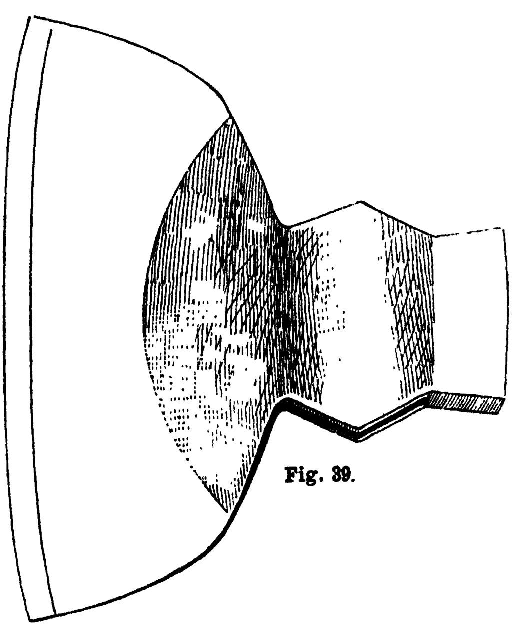


Fig. 39.

Side or Squaring Axes.—This axe is only used for squaring timber (Fig. 39). It is sharpened and kept like a chopping axe—(1) that it is only ground on one side, like a chisel; (2) that it should have the line of edge almost square.

The Maul.

This is made as shown (Fig. 40.) The best timber is ironbark, either white or red; grey gum is not so good. Mauls are made either out of a knotty piece of limb, or, better still, a piece of the quarter from a big tree; in either case, take the piece an inch thicker than the inside diameter of the rings, tapering gently from the centre to the ends, which should be trimmed so as to just fit the rings. This will allow the rings to work back as the face wears out. To put the rings

on, first grease the face and a couple of inches of the ends. Get the rings red-hot, slip them on, and quench with water, when they will shrink on tight and save the objectionable practice of wedging them on with iron or steel spikes, which burr the heads of the wedges. The grease on the maul will prevent the water injuring the wood. The maul should now be greased on the faces, and each face turned alternately to the fire a few hours every night for a few days to allow the grease to work in. When well greased, a maul face will keep smooth and sound, whatever the belting it gets in reason. The hole for the handle can be bored either when putting the rings on, or before using. In any case, it must be bored exactly in the centre, and at right angles to the faces. If not, the faces will not hit the wedge full, and will chew away unevenly. To bore, then, have the maul jammed tight in a fork or vice, and see that the augur is sharp and clean. If the augur runs, turn the maul over and bore from the other side. The size for a hole is $1\frac{1}{2}$ inches; plenty use only an inch, but the handle is then too likely to break, and when working to twist in the hand. Some bore an inch hole, and then with a red-hot piece of round iron burn out the other half-inch. Oak is the best for handles (forest oak), a straight piece of bough. Ironbark jars too much. The little bangalow palm makes a beautiful handle if thick enough. The handle should run thick at the top, as the bottom is slipped through from the top of the hole, and unless the top is thicker the maul is liable to fly off and hurt someone. The main thing about a handle is that it must be springy, or it will jar the user to pieces. I was splitting once with an old hand, who took it into his head to try a piece of gas-pipe for a handle. I told him it would jar, but he insisted on using it. We were splitting curly timber, and I took care to keep him going. He lasted till dinner-time, then by some curious accident his maul crept into the fire and got burnt. Of course, he had to knock off for the afternoon to make another maul. I noticed he put an oak handle in it then. He liked the gas-pipe all right, he explained, but was afraid it might break suddenly some time when working, and perhaps kill me, so he would use the oak one instead. Ahem!

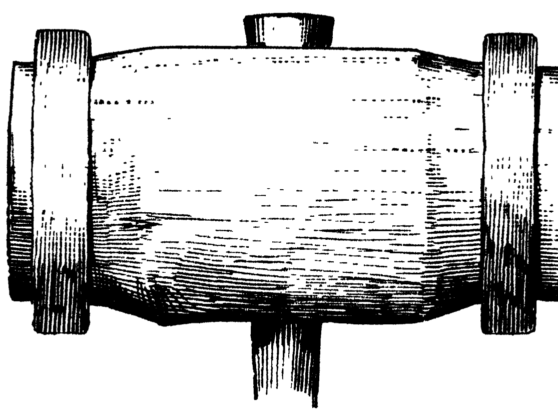


Fig. 40.

There are two sorts of maul rings, the thick narrow sort and the wide thin ones. I can not see that one has any advantage over the other. I prefer the thick ones myself, but that is because I have always been used to them. A maul for best results should always be short and heavy. It then falls on the wedge with a dead full blow

like a sledge hammer (by the way, with steel wedges, a sledge is a good substitute for a maul). A long light maul always tries to turn in the hand when falling, and bounces off the wedge when it does hit it, making the work much harder. New chums always make a maul long, so as to give it plenty of room to wear away. There is a certain amount of reason in this, as they will hit the wedge cornerways instead of with the full face. This wears a maul away very quickly. If, however, they made the maul short, they would find very little difficulty in hitting properly. The length a maul handle should be is a vexed question. Some like it long (about 2 feet 9 inches), others about 2 feet. I like the short handle myself, as what you lose in swing, you make up in handiness. I always have two mauls for splitting, a heavy one with a long handle for bursting, and a shorter one for billeting, or light work.

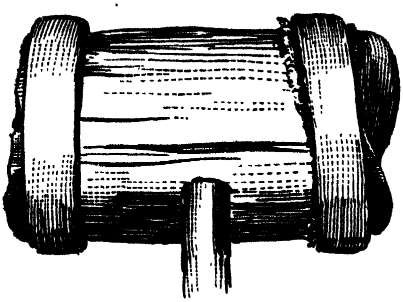


Fig. 41.

The essentials in a good maul are:—

That it is properly balanced and handled.
That it is made of suitable wood, well seasoned and greased.
That it shall be used properly and looked after.

Wedges.

These are another tool that should be smith-made, as very few shop wedges are any good. The great point about all wedges is that they shall be nicely tapered from the point, so that they shall enter the splits in the wood easily. The peculiar shape of this taper is shown (Fig. 42). If not well tapered, on being hit with the maul they fly, that is, jump out. This is very dangerous for the splitter, being likely to knock one of his eyes out in the flying. Plenty of wedges will "draw," or enter nicely till a quarter way in, when they will then "fly" like a bird. This is because the taper thickens too suddenly. At the same time, in a good set of wedges, only two of each are tapered exactly alike. A full set consists of eight wedges; two are very fine-tapered, strong wedges; these are for entering. The next two are very long, big wedges; these are for bursting, when the log is entered. The next two are similar to the bursting wedges, but a little smaller; they also are bursters. The next two are very short,

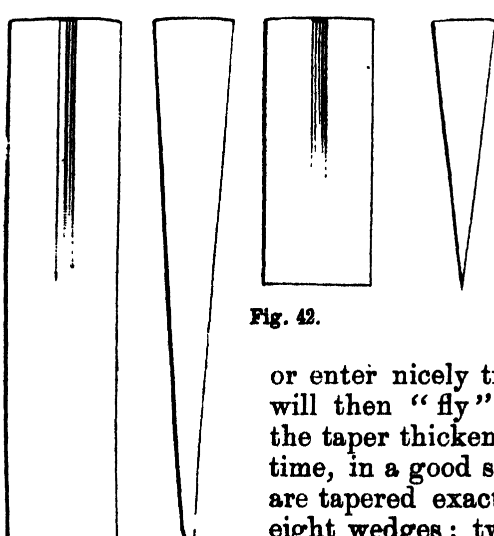


Fig. 42.

thick-tapered, little wedges; these are for backing the heart-wood off. If working in very free timber, you will only need to use about three wedges. I have in some splitting (free timber) done all my splitting with two and an old axe; but, on the other hand, in very woolly stuff, I have had to use twelve. The set should always be kept clean and smooth, and in a bag made for the purpose. This bag is a corn or wheat bag, cut in halves, and given a couple of coats of boiled linseed oil to keep the wet out. The top edge should be turned round, sewn up, and a rope slipped through it, like a child's tucker-bag. This will keep the mouth closed when carrying it. In a bag like this, wedges can be left out under the log and in wet weather come to no harm. An ordinary sugar bag is commonly used to hold wedges, but they soon wear through and lose the wedges.

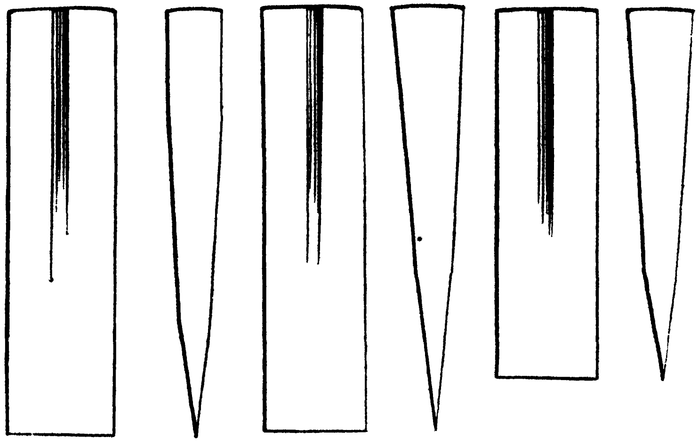


Fig. 43.

Wedges are generally spoilt either by the top being burred by mishits, the ring bashing them, or else by meeting the edge of another wedge or the wedge-axe, coming in from the other side. To stop this, always be careful, when splitting from the other side, to know where your wedges are, and enter the second lot so as to clear them. Once the point of a wedge is chopped or misused, it takes a skilful smith to fix them up again.

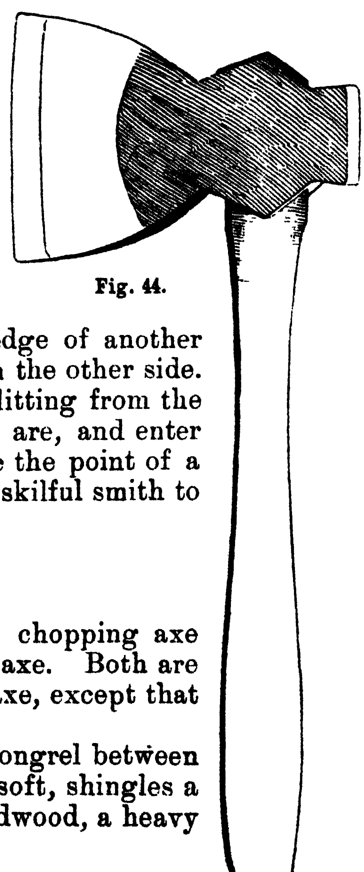


Fig. 44.

Tomahawk.

There are two sorts, one like a small chopping axe (Fig. 44), the other more like a squaring axe. Both are sharpened and handled like a chopping axe, except that the handle is only half-length.

The shingling tomahawk is a sort of mongrel between a hammer and a tomahawk. For light, soft, shingles a light narrow-bladed one is best; for hardwood, a heavy broad-bladed one is to be preferred.

Adze.

There are several shapes of adzes, but the only two we need concern ourselves with are the fencing adze and squaring adze. The fencing adze is short and thick, as made at the present time. Here, again, it is too commonly a shop tool, and like the majority of them. A smith-made adze of thin, solid steel is far before a shop one, but very few smiths can make them. The shop adzes are all iron but on the bottom, where a very thin plate of steel is welded on to give a cutting edge. An adze is only ground and sharpened like a squaring axe, from the top side. A great deal of an adze's working for good or bad depends on the bend or "come" of the blade. When too full, or over-bent, it is very hard to work; when too straight, the user has to stoop too much in using. To work an adze so that it will not nick the user's ankle or shin, always keep

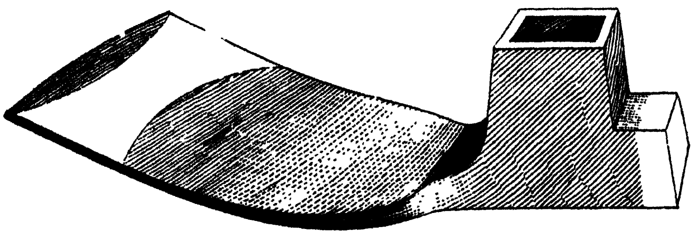


Fig. 45.

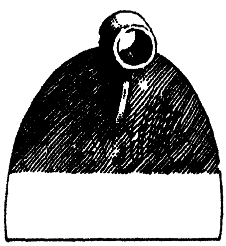


Fig. 46a.

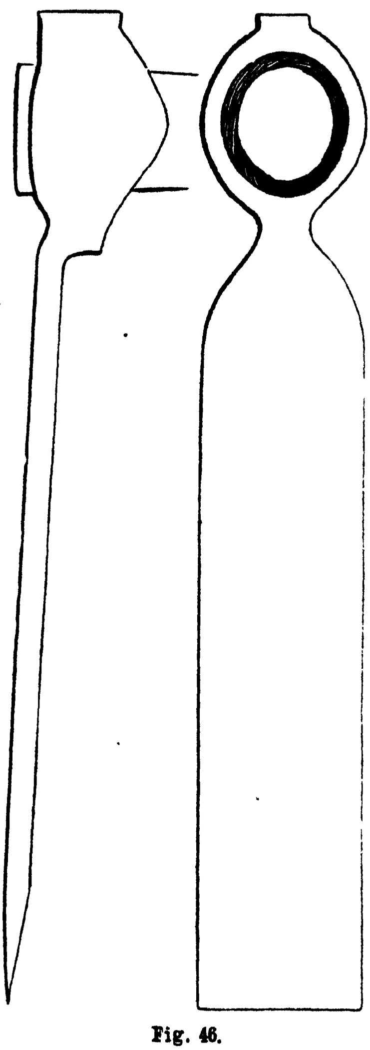


Fig. 46.

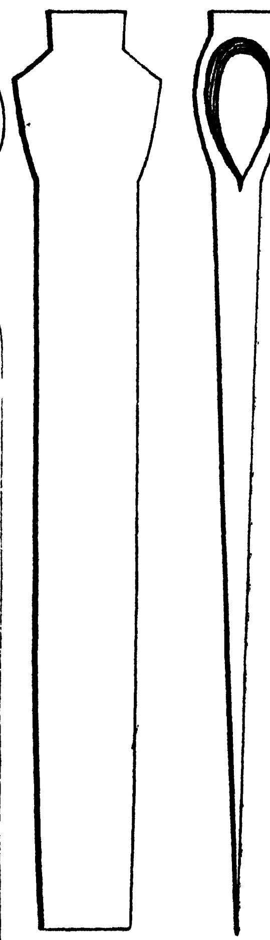


Fig. 47.

the left elbow sliding against the left hip. This keeps the blade straight and off the legs.

The squaring adze is long-bladed and thin, with the same sweep as the fencer's.

In putting in the handle, always wedge it at the back with a thick piece of leather or stringybark-bast. This keeps it from working loose. To grind an adze, of course you knock the handle out first. Don't leave the handle too long; cut a bit off the small end, or it will catch you in the groin, just like the heel of an axe, when working. You must cut off to suit your size, as no two men like the same length.

Hoes.

These are of two sorts, fencing and chipping. The chipping hoes (Fig. 46a) are so well known that description is unnecessary.

The fencing hoe is a different tool (Figs. 46, 47). In fair sinking, a man used to one can sink post-holes about twice as quickly as any other way. In hard, stony sinking, undoubtedly a spud (a wide-bladed short bar) is better. The fencing hoe proper has to be smith-made, as they are not sold in the shops. The blade should be 3½ inches wide and from 13 to 15 inches long, with the "come," or sweep, outwards from the eye. The reason for this outward sweep is that the fencer can then chop his hole down straight; if bent in the ordinary hoe-shape he can only chop at an angle. I have seen these hoes made 18 inches long, but in my opinion they did not pay, being too clumsy.

This hoe must be made of good stuff, or it will fly or twist when hit on stones. The handle should be about 4 feet long, tough stringy-bark or oak. An ordinary mattock with the axe end broken off makes a very good substitute; the blade, however, requires to have a few inches of steel welded on to it to give it the length, and it must also be bent to the outward sweep.

Mattocks.

These should be of two sorts, as shown (Figs. 48, 49). The broad mattock is very useful for shallow grubbing, chipping out tussocks, road

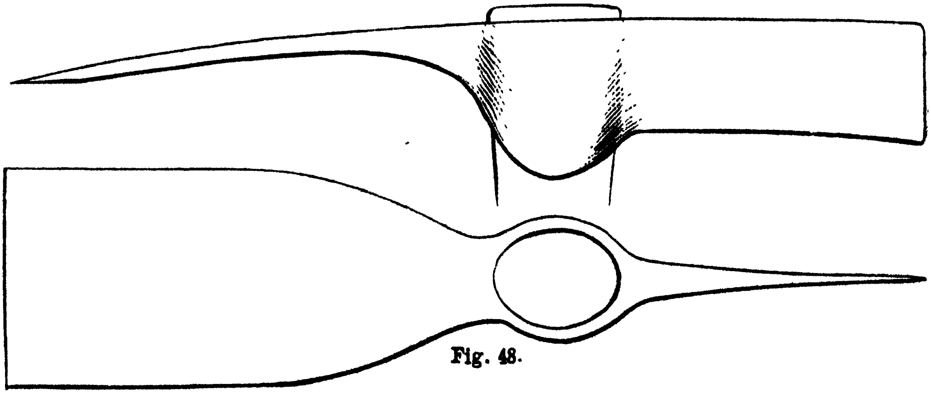


Fig. 48.

making, whilst the narrow one shines at grubbing, as its strength of blade and narrow width allow it to go under the biggest roots and

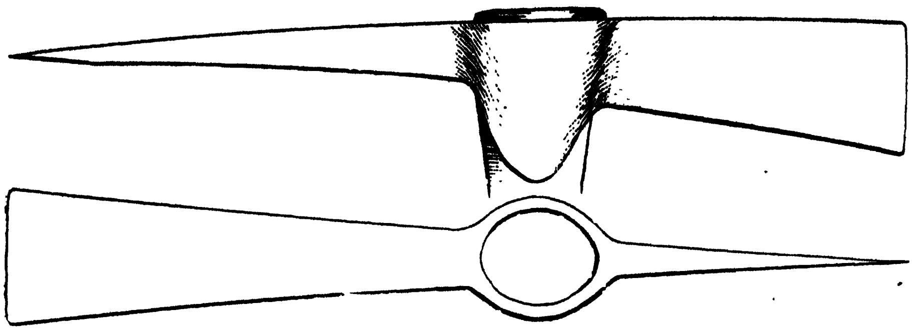


Fig. 49.

into small corners without fear of damage. These are, of course, shop-made, as it does not pay to have them forged. There is little art in picking them, as, if of a good brand, they are much alike. Gilping's and Collins' are the best I have used.

In handling them, slip a bit of old, soft boot-leather into the eye, and jam the handle on it. It holds better and works easier.

Spades.

There are two sorts of these—digging and fencing. Of the digging spade there are two sorts, the steel-bladed and the iron. These last are man-killers, and should be avoided, like the lawyer-vine. Of the steel, the two now on the market to be used are Parkes's and Skelton's. The Parkes spades wear a bit longer than the Skeltons, but are rather heavy. Both are fine spades to use. In picking one, take a medium

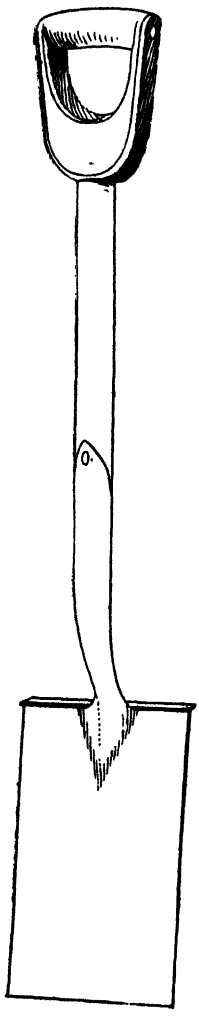


Fig. 50.

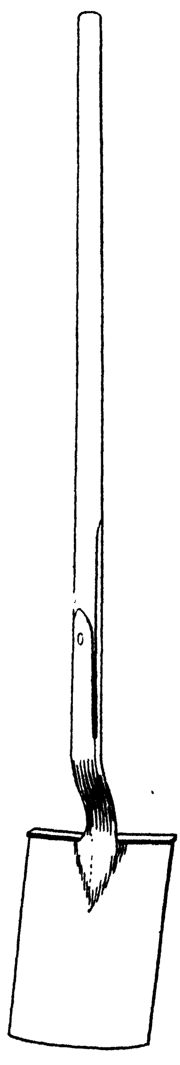


Fig. 51.

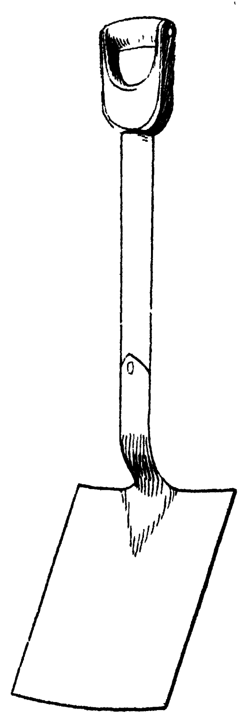


Fig. 52.

weight; that gives the best results. When the D in the top of the handle breaks, as it generally does, put in a malleable cast D, and the spade is as good as new. Always keep the edge of the spade sharp, with a flat file; it works easier. The fencing spade is used for cleaning out post-holes. There is little difference in these shop-made. The strapping along the handle, from the blade, is too short always, as when down about 18 inches, the edge of the hole is chafing on the wood beyond it. To get over this, screw on a piece of strap from an old spade above it, and renew it when worn out. This doubles the life of the spade in gritty soil.

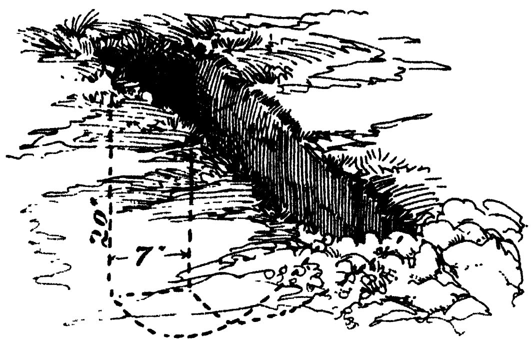


Fig. 52a.

Shovels.

There are round-nosed and square. Parkes's "Wheel" brand are the best. One long-handled round-nose, one short-handled ditto, and one short-handled square-nose, are a full lot for the settler. In picking the long handle, bend the handle to test the spring; to work easy it must have a good spring. The short round-nose is for shovelling sand, and road-making, and the square one for manure.

Throw (shingle and paling).

Usually misspelt *froe.* These are listed as two sorts—the shingle and paling throw, but as the only difference is a few inches in the length of each, one description will do for both. The throw, like the mortising axe, should be smith-made, as the shop throws are unusable. See a good smith's throw (Fig. 53) and a shop ditto. A good throw should be of the best steel, and should be bevelled straight from back to edge, with the edge sharp, so that the paling or shingle can be trimmed by it. The handle should be round and straight (a good piece of oak or ironbark is the best), and about 3 inches longer than the blade; the eye should be round and slightly tapered from the bottom.

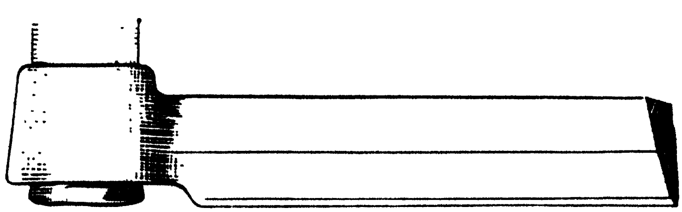


Fig. 53.

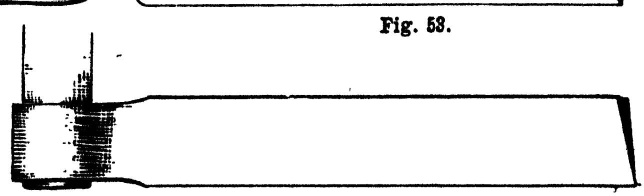


Fig. 54.

Augurs.

There are several sorts on the market, but the best for a settler are Mathieson's. Three are required, a $\frac{1}{2}$-inch or a $\frac{5}{8}$, a 1-inch, and a $1\frac{1}{2}$-inch. The best handles are of round sheoak, about 14 inches.

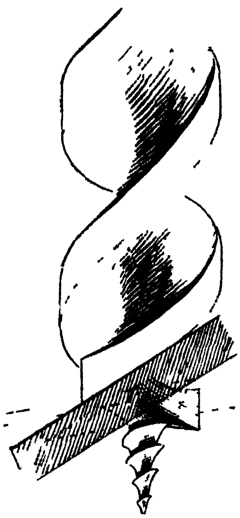


Fig. 55.

Fig. 56.

Some fencers now put a crank in their augurs, and use it like a brace and bit. This is right enough for fencing, but makes the augur too short for some jobs.

The great thing about an augur is to keep the thread on the point clean, so that it bites well, and the cutter and blade on each side sharp. The augur will then almost bore itself, and is a pleasure to work. Always be careful to keep your augurs where they will not get knocked about; as a further precaution I always keep a big cork on the point of each of mine.

When your augur begins to get dull, put it in a vice, or jam it in a fork with your foot; take a small sharp three-cornered file and file the blades up, being careful to file their faces so that they slope *towards* the wood when entering. If you file them flat, a team of bullocks will not make them enter, as the angle of resistance is then parallel to the wood. All augur bits cut the same way. Be careful to file the cutters from inside, not outside, and when giving the last rubs to the face, rub well into the top of the thread, so that the thread has got a clean entrance grip all the time.

Block and Tackle.

Block and tackle consists of two pulley blocks, a double and a single, and about 100 feet of wire or hemp rope. With this tackle the settler can shift logs about, with two light horses, that without he would have to employ a bullock team to move. He can also lift posts and building material by himself, when without the block and tackle he would have to employ a couple of men.

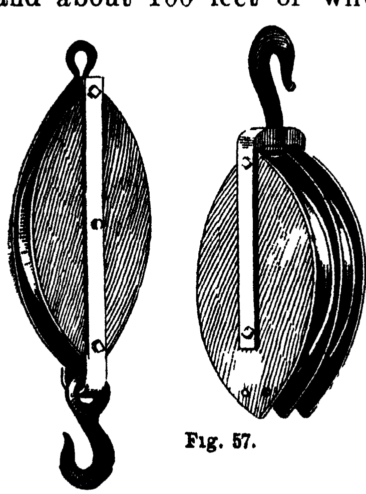


Fig. 57.

The blocks may be either wood or iron (wood is a little cheaper but less durable); 4 to 5 inches in the pulley is a nice size; if bigger they are too heavy to handle for ordinary use. For log-shifting the single one is all that is necessary, the double as well taking too much extra rope and fixing; but for lifting, the double is necessary.

Bars.

The shapes of these are various, but the spud shape is the best of the lot. This is a round bar, about 4 feet 6 inches long, with a round top at one end for ramming (about $1\frac{1}{2}$ inches across), and a blade (steeled on) about 9 inches long, on the other, wedge-pointed and $2\frac{1}{2}$ inches wide (Fig. 58.) Almost any bar work can be done well with this gentleman, and he is unequalled for fencing. Like the throw, he should be smith-made.


Fig. 58.

Straight-edges.

These should be on every place, as they save a lot of time and trouble. They should be of cedar (old red seasoned) if possible ; if not, the next best is sugar or clear pine, then Kauri, then colonial, then Oregon. The reason for being particular in these timbers is, that once a straight-edge is proved straight, it should never twist out of shape, as by doing so it is, of course, worthless. These timbers, in their order, are the least likeliest to twist of any on the market. I have left out Baltic, as its knottiness causes it to break too easily. The straight-edges needed are three—a 3-foot for small work ($1\frac{3}{4}$in. x 1-inch), a 6-foot (1in. or 2in. x 1in.) for larger work, and a 10 or 12 foot (3in. x $1\frac{1}{2}$in.) for large building work. They should all have the feet and half feet plainly marked on them in large pencilled letters, and, excepting cedar, should be well primed with raw oil. Now to make them.

First of all, pick the straightest-grained piece of timber you can find, free from knots or "shakes" (flaws). Plane it up clean, then shoot one edge up with the trying plane as true by the eye as you can, and square it true. Now brush the bench very clean, or, better still if you can, lay this edge on a dressed board longer than itself. Now, with a sharp-pointed pencil, mark the line of the edge along the board or bench under it, keeping the edge firm and still. Now turn the edge over, put its edge on the pencil line, and, if true, it will lie exactly on it ; if untrue, it will lie hollow or full across the line. These places must then be shot up with the tryer till the edges from either side give the same line. Then gauge carefully from this trued side for the other side, shoot it up to the gauge line, and then your edges are parallel and a perfectly straight line each. If, when in use, the straight-edge shows a disposition to twist, bore an inch augur-hole every 2 feet along the centre ; this breaks the grain.

Tape.

This is essential for measuring building distances, yards, falling, clearing, &c. The best size is 66 feet or 2 chains. The tape should be self-winding, in a leather case, and should be a metallic one—that is, the linen of the tape is interwoven with fine brass wire, thus preventing it from stretching out of its true length as a linen one will

always do. The all-steel which builders use is slightly truer, but three times as costly, and awkward to handle, also liable to rust. The all-linen tapes are cheaper, but are not durable, and stretch so much that they cannot be trusted.

Line.

A 50-yard hemp line is very handy for marking long distances, and points to be cut on points too far apart to be reached with the straight-edge. It should be wound on a big reel and kept free from knots. For marking, chalk, whiting, charcoal, or burnt grass dissolved in water are all good.

Cant Hook.

This is one of the most useful tools on a new place. It should be of the shape and size shown (Fig. 59). If the sweep is not right, the hook will not drive into the log properly, nor keep its grip when

Fig. 59.

driven. For rolling logs over for trucking or burning off (no log will burn if left where it has bedded itself), or parbuckling logs on top of others, a badly-made one is very dangerous, as it will slip and let the log go, just when it should not, and very likely kill a man or a couple of the bullocks. It will also hang on too long on other occasions, and pull the log over on top of them.

(*To be continued.*)


A
B
× 5½
C
× 5½

Useful Australian Plants.

By J. H. MAIDEN,
Government Botanist and Director, Botanic Gardens, Sydney.

Ischæmum.

Spikelets in pairs in the alternate notches of the articulate flexuose rhachis of simple spikes, one sessile with one hermaphrodite terminal flower, and a male one below it; the other pedicellate and either similar or with only one hermaphrodite or one or two male flowers, or reduced to empty glumes.
Spikes, either solitary, or two or more, sessile or nearly so at the end of the common peduncle.
Glumes in the sessile spikelet four, the outer one the largest, awnless, truncate or two-toothed at the top.
Second glume keeled and sometimes produced into a short straight awn.
Third glume rather smaller, thin, enclosing a palea and three stamens.
Terminal glume, a twisted and bent awn, attenuate or hyaline, and bifid at the base, as in *Andropogon*.
Palea, small, and thin, or none.
Styles distinct.
Grain, enclosed in the glumes, but free from them.

No. 92. *Ischæmum triticeum*, R.Br.

Botanical name.—*Ischæmum*, said to be from *ischæmon*, a plant referred to by Pliny: " A herb like a hyrse, having sharp leaves and moss; it is good to stop blood." It is said that the woolly seeds of one of the species were used as a styptic; *triticeum*, Latin, wheat-like.

Vernacular name.—" Wheat Grass."

Botanical description.—(B.Fl., vii, 519):—Very near *I. muticum*, but a coarse plant, ascending to 2 or 3 feet.

Leaves mostly long and broad, contracted at the base, or scarcely cordate, glabrous or the lower sheaths hairy.
Spikes, two together, 3 to 4 inches long.
Spikelets, 4 to 5 lines long, more acuminate than in *I. muticum*.
Outer glume, smooth and shining at the base, several nerved, and often ciliate, with a few hairs at the end, the wings of the lateral nerves often unequal.
Inner glumes, rather rigid, the third with a rigid palea and male flower, the fourth under the terminal flower more hyaline, shortly two-fid, the awn usually exserted, and sometimes ½-inch long.
Pedicellate spikelet nearly similar, but, as in *I. muticum*, rather narrower, the wings and nerves irregular, and the awn often shorter.

Value as a fodder.—A coarse grass, of but little value for fodder.

Habitat and Range.—A common coast grass in Queensland and Northern New South Wales. In this State, Fraser, a former Superintendent of the Botanic Gardens, Sydney, collected it " on low hills, near Port Macquarie." Wilcox collected it on the Clarence River, probably near Clarence Heads.

REFERENCE TO PLATE.

A. Part of rhachis.
B. Pair of spikelets, one sessile, the other pedicellate.
C. Sessile spikelet, showing the glumes and palea.

Hawkesbury Agricultural College and Experimental Farm.

"Wet Rot" of Potatoes in the Hawkesbury District.

By C. T. MUSSON (Botanist) and GEO. MARKS (Experimentalist),
H.A. College, Richmond, New South Wales.

An interesting development in relation to "wet rot" of potatoes has lately occurred here. Amongst our experimental potato plots* there appeared during November, 1904, some trouble, which rapidly killed off odd plants here and there through most of the varieties. Very rarely were two neighbouring plants attacked; two plants might even be touching one another, and only one would be attacked, the other remaining healthy.

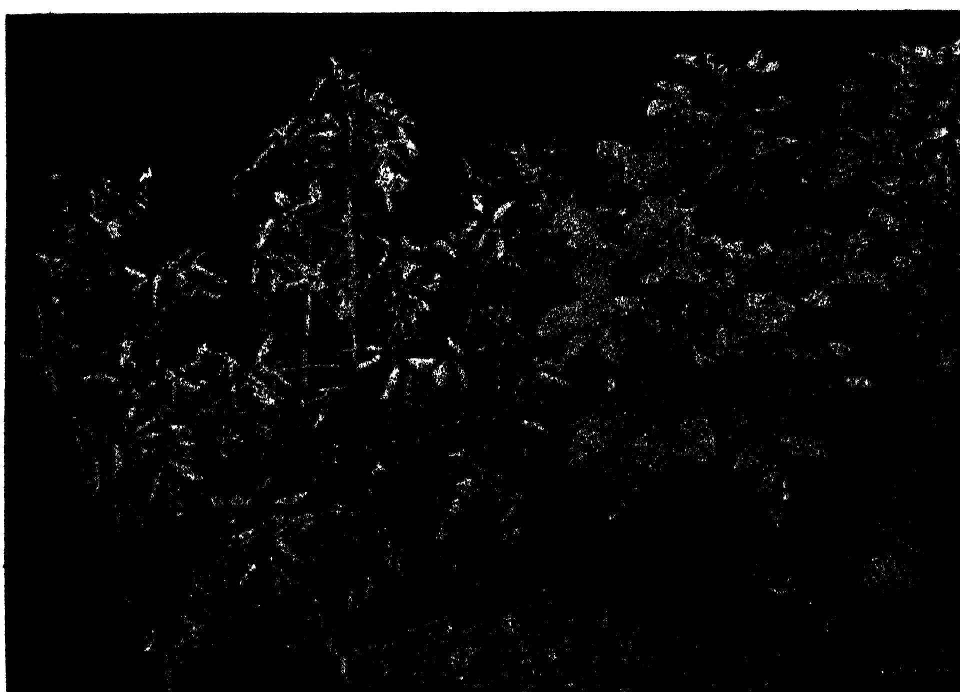


Fig. 1.—A wilted plant, growing side by side with healthy plants, showing characteristic appearance in early stages of the trouble.

This isolation of attacked plants pointed either to some cause existing in small patches of ground, which, under the circumstances exhibited, could not be the case (for instance, were the cause scattered

* And at other places in the district.

haphazard it could not appear so regularly in the rows), or to its having its origin in the tubers planted. Careful examination was made of a number of the diseased plants along with neighbouring (apparently healthy) plants, with the result that we seem to have a case where "wet rot" (a disease of bacterial origin) is being transmitted from the original "set" to the general plant body, stem, leaves, and newly-formed tubers.

The case seems to be of such importance as to warrant some detail regarding treatment of ground and "sets" previous to planting, climatic conditions prevailing, symptoms of the trouble, conclusions arrived at, together with certain recommendations.

Treatment of Soil and Crop.

The soil consists of a light red sandy loam. The ground upon which these potatoes were grown was previously cropped with maize

Fig. 2.—Late stage, showing plant dead alongside healthy plants.

and cowpea, the stalks and vines of which were ploughed under last autumn. On account of the moist conditions then prevailing, they were rapidly decomposed. Early in the spring the land was again

ploughed and worked to a state of fine tilth. At time of planting, the soil was in splendid order—friable and moist; drills were struck out with the plough, 2 ft. 6 in. apart, and about 4 inches deep, the "sets" being placed along the bottom of the drills, 14 inches apart. Potatoes had been grown upon this ground two years previously.

On that portion of the plot where cow-pea had been growing, no manure was used; on that previously occupied by maize, various chemical fertilisers and well-decomposed farmyard manure were used, these being placed along the open drills before planting.

The potatoes sprouted well, and during the early stages made good growth. The land was kept loose and clean by frequent use of the cultivator.

Treatment of the "Sets."

The cut tubers were dipped in lime before planting. This is believed to assist in quickly drying up the cut surface, whilst, no doubt, it acts as a repellant in keeping away such underground feeding insects as wireworm larvæ and certain cockchafer beetles, which lately have taken to feeding on our root crops.

Some of the tubers were dipped in corrosive sublimate (1 oz. to 16 gallons water) as a safeguard against scab.

Climatic Conditions.

Planting took place 23rd August. From that date, and up to the end of November, when this investigation was completed, the rainfall was as under, in points:—

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Aug. ...	...	..	6	...	...	...	...	1	..	...	...	...	8	78	44	...	...	..	...	...	...	...	..	...	...	...	40	3	..	...
Sept. ...	...	...	...	...	...	...	...	...	...	...	.	..	..	..	...	.	..	...	4	...	...	..	..	...	..	36	11	2	...	...
Oct. ...	...	...	...	1	...	...	...	..	...	14	50	34	28	33	17	..	2	..	7	...	...	...	..	...	...	...	...	...	...	...
Nov. ...	...	6	...	...	...	...	.	...	...	...	68	...	7	...	.	48	7	...	..	...	...	...	...	..	...	..	26	...	1	...

Although there was apparently useful rain, dry conditions prevailed throughout the period of growth, severe drying winds being experienced to such a degree that many leaves were burnt at the edges, and the usefulness of what rain did fall largely minimised, evaporation being very heavy. At no time have the plants been subject to heavy rain, whilst at time of writing the top 9 inches of soil is very dry. Had the soil been wet during the sprouting period most of the tubers which were diseased before planting would probably have rapidly rotted—usually the case under such circumstances. Under dry conditions the trouble is perhaps more insidious, as plants are developed capable of producing tubers apparently healthy, but in reality all inoculated with the disease. No doubt the state of the planted "set," as to whether far gone in the disease, or only touched, may have a considerable effect on the resulting growth.

It is interesting to note that 75 points of rain fell December 16th and 17th, and on December 19th the flaccid stems of such plants as were not irretrievably gone stiffened out again, indicating that the roots and root hairs were still in working order; death of the plant is only in such cases postponed for a short time.

Symptoms.

During November it was found that odd plants scattered irregularly here and there throughout the plots, suddenly showed signs of wilting; the leaves became pale in colour, losing rapidly their ordinary dark green appearance. This paling soon becomes more marked. Meanwhile, the stem becomes yellow, in a short time loses its turgescence and falls over on to the ground, by which time it has lost all its leaves, the progress of the disease being very rapid.

The trouble was not noticed until the plants when vigorous were nearly full grown and in flower; in some cases, however, the plants were only half grown, possibly consequent upon unfavourable conditions, or perhaps to the advanced state of the disease in the "set."

Fig. 3. A wilted plant with "set" and new tubers, as dug from the ground.

In the earliest noticeable stage, when the leaves are wilting, examination of the underground parts revealed that the "set" from which the new growth comes is invariably found to be more or less rotten. If the plant shows but mild symptoms of the trouble, the "set" is often but slightly affected; if the attack is bad, commonly the "set" has rotted away entirely, or an empty skin remains. The young tubers formed on these plants varied in size from that of a pigeon's egg to full-grown, largely according to the age of the plant.

Up to this period the disease did not appear to have had any effect upon the number or size of the tubers formed, which, to all appear-

ance, are exactly the same as those produced by neighbouring plants. In some cases "sets" were noticed in which only one eye had shot; another eye would be just sprouting. This only occurred where the "set" was not badly rotted.

Wherever the trouble occurred, that part of the stem from the "set" upwards to about the soil surface had its interior brown, and, in many cases, actually rotting (Early Rose the variety specially examined). On cutting across the tubers at right-angles to the line of growth, it was found that along the region underlying the skin, and approximately a quarter of an inch therefrom, the usually colourless ring of vascular bundles (the cambium—that portion of the tuber through which the nutritive material runs from which the tuber is

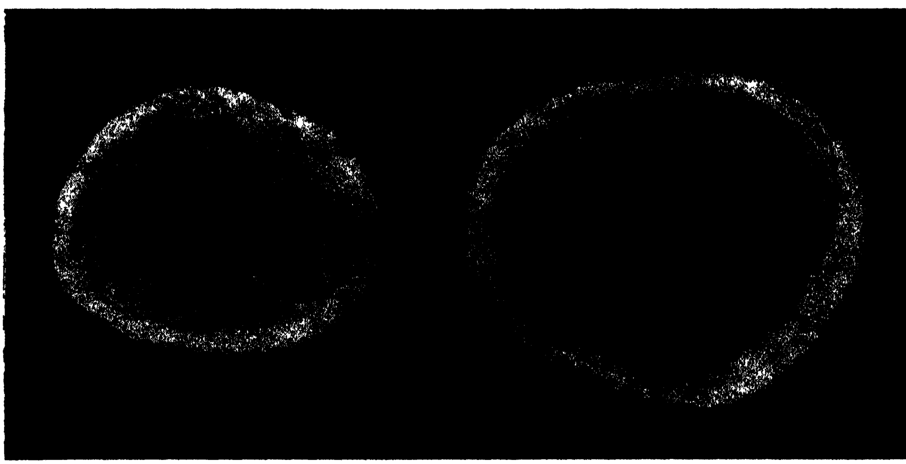


Fig. 4.—Cut tubers, showing healthy and unhealthy appearance.

built up) showed distinct brown discolouration, looking like faint brownish spots. In healthy tubers this discolouration was not present, though portions of the tuber, especially towards the skin, are frequently coloured purple; this colouring runs, however, through the flesh in largish patches. There is also a somewhat transparent centre in all potatoes, with radiating lines of a similar character running towards the vascular ring. In these parts the starch is smaller in quantity than in the whiter portions of the tuber. Excessive development of this transparent, watery appearance is a bad sign, meaning poor quality, in that less starch is present, whilst it is a frequent symptom of bacterial disease.

No other trouble we have seen is exactly like this. Plants subject to it can easily be distinguished from such as are suffering from drought or sunburn, the ordinary fungus diseases, eel-worms, or the common root-feeding insect pests. Examination of the underground stem and tubers quickly decides the cause.

Importance.

This trouble is of some considerable importance, for unless checked at once the infected tubers will be mixed with the harvested crop, to the extent of, perhaps, ¼ or ½ per cent., being apparently sound. These

would pass into general use, and some probably be kept for planting purposes; these latter would contain a certain quantity inoculated with the disease, ready to start the trouble again on being planted; the resulting crop would give a larger number of diseased plants, and if harvested as a whole must contain an increased number of infected tubers.

In this way we should (as has been the case with us) be planting tubers already infected with the germs of "wet rot" without knowing it—a trouble we ought to be extremely careful to keep clear of if possible; for if once in the ground it may remain there for a considerable time, and will attack, in addition to potatoes, beet, pumpkins, and other crops.

There is no doubt that our potatoes contain this trouble to a large extent, and, judging from experience, it is probably one cause why this product will not keep.

Moreover, we are, unfortunately, not the sole possessors of this disease. Since first commencing to look into it we have reports from two sources—at Windsor and Richmond—confirming our own observations and opinions. From two practical farmers we hear that their potatoes are going off in exactly the same way as is herein described, and examination of the Windsor potatoes confirms our conclusions. It is believed that the disease only came in the seed potatoes used this season. It has not been observed before, whilst, when being cut for planting purposes, the tubers were noticed as having the brown ring of spots referred to as an indication of the presence of the disease.

Origin of the Trouble.

From certain tests carried out, there can be no doubt but that "wet rot" is the cause of the trouble, and works back from the infected "set" into the main stem, thence to the aerial stems and the newly-formed tubers, in the latter to remain dormant for a time.

The plant does not die, however, until it has had time to develop tubers and go on growing up to a point when the trouble has worked up the leafy stems; a time must quickly come when they die off, and all progress is then quickly stopped.

From what has been said, it will be seen that the cause arises from the planting of infected tubers, to all external appearance healthy, which had been harvested along with sound tubers, doubtless without a suspicion that anything was wrong. This is the special feature to be noticed, to which we wish to draw attention.

It should be noted, therefore, that this disease does not in every case come to the potato plant from the soil; originally it must have done so, but at the present time probably many cases of this disease could be shown to have originated in the same manner as has been described above.

No doubt growers, seeing a few odd plants in the potato patch wilting here and there, would pay but little attention to the fact, perhaps thinking that the particular plants were ripening early, except in the case of small or experimental crops receiving more careful

attention in the way of special periodical examination, when such an occurrence as the rapid and early wilting of individual plants would call for examination into the cause, as was the case here.

The dormant condition of the disease in the newly-formed tubers is an important point to note in connection with using of tubers for seed and the storing problem. Apparently it is when favourable heat and moisture conditions start the fermentative processes in the tuber at sprouting time that the germs start off into active life again. The conditions of storage in our warm climate are peculiar. The frequent moist-air periods, together with the absence of continuous cold to retard shooting of the buds, no doubt are such as to encourage the development of the organism, and thus increase the chances favourable to a production of the trouble.

General Conclusions.

From our experiences of the present season with respect to this trouble, we conclude :—

1. The disease appears in many varieties.
2. It is not hindered or hastened by any special manurial treatment.
3. Climatic conditions probably affect the resultant growth as regards degree. In dry seasons it is probably not so virulent, and diseased tubers are produced ; in wet seasons it may be more virulent, and fewer diseased tubers result.
4. The disease does not always come to the potato plant from the soil, but, as in this case, *is caused by planting "sets" already containing the germs.*
5. There is no external sign in the harvested tubers that disease is present.
6. Internally the disease can be judged to be present by characteristic brown spots showing in an irregular line running at a short distance under the skin.
7. Our "sets" coming from various places of growth, it would appear that the disease is widely distributed, whilst it occurs in the condition described over a considerable area in this district.
8. Unless growers take some steps to prevent it, the disease is likely to assume serious proportions ; the loss in our district crops and in stored tubers is already considerable.

Recommendations.

The following recommendations are urged, and the matter may be looked upon as of considerable importance :—

(*a*) Care should be taken, as far as possible, to see that none but healthy tubers are planted.

(*b*) "Sets" for planting purposes should only be used after careful examination, though under existing circumstances it is not always possible to sample the tubers before being bought for the purpose. Even were it possible to do so, it is not always easy for the inexpert eye to determine whether the disease is present or not.

(*c*) It is advised that growers make an effort to raise new varieties from real seed obtained from the so-called potato apple. Details as to how to go about this can be supplied on application.

(*d*) During growth, if a potato crop shows signs of the disease, all plants attacked should be dug up and *destroyed*—tops and tubers, the former by fire; the latter should be boiled for pig food. On no account should they be fed to stock raw, nor should they be put with healthy tubers. If this is done one important cause of infection would be removed.

(*e*) Do not plant potatoes on ground that has had the disease until at least the third year afterwards.

Summarising, with respect to the best method of preventing the spread of this trouble,—

Firstly—Do not harvest with the main crop any tubers growing on plants that have prematurely wilted. Harvest such early, burn the stems, and boil the tubers for pig food, leaving nothing on the ground.

Secondly—See that tubers for planting are free from the disease.

Hawkesbury District Farm Notes.

H. W. POTTS.

December and January were two dry months. The rainfall in the former month was about ½ inch, whereas our average is about 2 inches. At the end of the year we were visited with a heat wave which extended over a lengthened period. The results were disastrous to all the maize crops on the uplands. Many crops on the exposed areas of the river bank also suffered severely, especially the late crops. The early sown crops had cobbed well prior to this heat, and hence were fairly safe. All other crops, such as millets, sorghums, lucerne, pumpkins and squashes, have suffered. The only crops which have received no check, and evidently revel in heat, are the cowpeas.

The soil is very warm and dry, and the outlook is most discouraging to get the ground in order for the autumn and spring crops.

Maize.—It will not be advisable to continue further sowings of maize this month, as the possibility of enough moisture being available is too uncertain to ensure rapid germination of the seed. Attention should be devoted to the standing crops, and where the plants have failed to cob and are fairly green have them cut for ensilage. There is a steady increase in the demand for silage for winter feed for dairy cattle. One of the lessons of the late drought was the importance of silage replacing green fodder. Unquestionably, chaffed maize silage conserved in a tub silo provides the cheapest and most nutritious and palatable form. Where tubs are not available, the pit may be used, or, as a last resource, the stack. Farmers when adopting the latter

form of conservation must be prepared to stand considerable loss, both in waste fodder as well as a lower percentage of digestible food throughout a stack.

Sorghum.—Further sowings of this useful fodder can be made this month, and the best variety for this district is Amber Cane. It will withstand the early frosts better than other sorts. It will be useful for both green fodder and for ensilage. The advantage of having a quantity put in this month is that it comes in for use when maize is finished. We have fed sorghums green to our cattle at this farm up to the second week in June, and then had a lot for turning into the silo tubs. The earlier sown crops will require active attention this month in the form of shallow cultivation to conserve soil moisture and keep down the weeds. We may reasonably expect from 7 to 12 tons per acre of succulent and palatable fodder eminently suitable for cattle, pigs, and sheep. There is no question about the drought-resisting qualities of Amber Cane once it is established, and in that regard it is superior to maize.

Millets.—Our previous experience of millets points to them being desirable crops to grow for green feed. The French, Hungarian, and Broom varieties may be sown early this month. They are susceptible to frost, but as the former grows vigorously and matures in sixty days, there is reasonable time to take off the first crop for green fodder at the end of the summer and graze off a second growth before low temperatures prevail. One advantage is that the crop requires little cultivation. Sometimes the first crop is fed off early by sheep, and the second crop cut for hay, but it is somewhat risky to do this.

Sweet Potatoes.—The planting out of these may be continued this month; full directions for this were given in illustrated articles written by our experimentalist, Mr. Sutton, in August and September issues of this *Gazette* last year.

Pumpkins and Melons.—These have not been so successful this year owing to the shortness of rain. The later sown varieties require still to be cultivated, and kept free from weeds.

Bush squash or marrows may now be planted, especially the custard varieties, seeing they mature quickly, and give good returns in two months. They require to be freely manured with farmyard manure, and as they are compact in their habit and growth, they can be planted 6 feet apart.

Potatoes.—The second, or late crop, may be put in towards the end of this month, provided there is sufficient moisture. It is best to use medium-seized whole potatoes rather than cut ones for sets, to avoid the chance of dry rot setting in. Plant those tubers which have sprouted. Use only well-shaped, clean-skinned potatoes for seed.

Cereals.—The land may be got ready for the main crops as early as possible. We are experiencing a dry summer, and it often happens that a wet winter follows such conditions. Where early green fodder is required for dairy stock, it is best to put in small crops of wheat, and some mixed with vetches. Blount's Lambrigg has given good results in the past, also Bobs. Barley and vetches make a splendid green forage crop, and thrive well in our light, sandy

soils, where they are well drained. Rye will provide a good supply of green feed, and possesses the advantage of doing so on poor, loose soils. In fact it may be grown profitably on lands unsuited for other cereals.

Green Feed for Winter.—Autumn, winter and early spring crops for green feed may be provided for this month, so that a continuous succession of green crops may become available at periods when grass is scarce. It is possible to do this along our coastal areas, seeing there is sufficient rainfall to keep the crops growing. A judicious selection of fodders should be made, and some put in this month, amongst which may be mentioned vetches, peas, clovers, beans, lupins, cattle cabbage, rape, kale, kohl rabi, turnips, mustard, swedes and mangolds.

Rape.—Provided there is a fair rainfall, it will be wise to put in a crop of this valuable fodder plant. Every year we are becoming more convinced of the importance this fodder is to the stockowners. When it is considered that twelve to fifteen weeks after sowing the crop is ready for feeding, we can readily see how important it is, especially after a dry summer. We have had a crop weighing 11¼ tons to the acre seven weeks after sowing, but that was under exceptional conditions, favouring rapid growth. We have found the best results from the seed sown broadcast. Where, however, there is insufficient moisture, it will be best to put it in by drills 2 feet apart, 4½ lb. to 5 lb. seed to the acre; broadcast, 6 lb. are required. The ground should be well cultivated, and brought to a fine tilth. The Dwarf Essex is the best variety. On light sandy soil a good dressing of bone-dust two parts with one part of blood manure, affords ample plant food.

Cattle Cabbage, Kale and Kohl Rabi.—When required for fodder purposes these may be sown in drills after the land has been thoroughly cultivated. The plants may be thinned out later on. In each case the land must be well fertilised with farmyard manure, failing this, a complete artificial manure composed of superphosphate, kainit and sulphate of ammonia.

Lucerne.—Every chance should be taken to increase the area under this excellent green crop. Towards the end of the month the land may be got ready for a further sowing. Deep cultivation is essential, repeated ploughings, rolling and harrowing to secure a very fine seed bed is needed. The success of the growth so largely depends on thorough cultivation, fineness, cleanness and æration of the soil. When rain falls the opportunity should be taken to destroy any weeds.

Paspalum dilatatum.—So far we have recommended the planting of roots of Paspalum dilatatum owing to the uncertainty of the germinating power of the seed supplied. Some of it was as low as from ½ to 2 per cent. Considerable improvement, however, of late has been noted in the supplies coming forward from the northern rivers. Where it is properly harvested, hand shaken, and weighs from 18 lb. to 24 lb. to the bushel, it may be accepted as a good sample. The ground should be well cultivated and the seed sown immediately after rain during the warm weather. We have tested this season one small paddock and took off the first cut of green

fodder last month, eight weeks after sowing the seed. This very rich summer grass should be introduced wherever grass grazing is required in hot weather.

Pigs.—During this month some attention must be given to the sows to see that they have access to clean water both for drinking and wallowing in. Shade of some kind, either under trees, improvised shelters or sheds is required. The young pigs may be grazed on lucerne, Paspalum dilatatum, couch, sheep's burnet, cowpeas, soy beans, or millets, and where they are being got ready for fattening off, a few cobs of maize may be given daily in the paddock. Water and shade are essential features to their rapid growth. In the styes green maize or sorghum can be given with sweet potatoes, pumpkins, bush marrows and squashes to supplement the grain, pollard, and skim-milk diet and swill. During the hot weather the boar requires only a light class of food such as swill twice a day and a liberal allowance of grass, lucerne or millets.

A Suggested Supplanter of Lantana.

Following is an extract from a letter from A. W. Deane, licensed surveyor, Lismore:—

"I am sending by this post a packet containing a sprig of a plant which I found growing at Port Macquarie. I was informed by local residents, and saw for myself, that it is crowding out Lantana. Where Lantana was growing very thickly this plant gradually spread, and has taken the place of, and is thicker than, the original Lantana. It grows as a bush up to 10 feet high, roots only descending to a shallow depth."

The plant in question is *Polygala Myrtifolia*, one of the milkworts, and a native of South Africa. It has been cultivated in Australia for many years, and is a garden escape. It is a bushy shrub of a few feet, of no economic value, so far as I am aware, though if it supplants the Lantana it will probably be easier to eradicate than the latter. At the same time it is a case of one weed replacing another,—whether because the ground is Lantana-sick I do not know. The spread of this plant should be carefully recorded.—J. H. Maiden.

Orchard Notes.

W. J. ALLEN.

FEBRUARY.

MANY orchards in the County of Cumberland are feeling the effects of the continuous dry weather, more particularly those situated on shallow soils, and those which have not received sufficient attention in the way of ploughing, cultivation, and manuring—all of which are so essential in the upkeep of the orchard. Many an orchard in this State is slowly starving to death, all owing to the want of a little care and foresight on the part of the owner, who, so long as he allows his orchard to remain in this unsatisfactory condition, will continue to swear at his luck, the dry weather, the country—in fact anything and everything but himself, who is most to blame. If the soil is poor and worn out it will take a few years to bring it back to proper condition, and one of the best ways of doing so is to sow either cowpeas or tares among the trees, or vines, as early in March, as rainfall will permit. Where the land is poor a liberal dressing of blood or bone manure is very beneficial for the plants to feed on, and by sowing early the crop will make a good growth by the following August, at which time it should be ploughed under before the land becomes dry. If allowed to stand too long—that is, until after the rainy season has set in—it would be found most difficult to turn under, and the result would be damage instead of benefit to the trees. The green crop should on no account be allowed to develop seed.

Poor worn-out soil usually sets hard and dries out quickly, while soil kept in good condition by a proper system of manuring is loose and friable, holding the moisture better, and is in every way in better condition for withstanding the continued dry spells so frequently experienced during the summer months.

Keep a watch over the citrus trees, and if red or other scales are spreading either fumigate or spray, so that the coming crop will be clean and fit for export.

I have seen good crops of oranges in some orchards, but there are many which are carrying but little fruit, while the lemon crop does not promise to be a heavy one this year.

Remove the bandages from apple-trees regularly, kill all grubs found in them, and pick up and destroy all fallen and infested fruit.

In a letter which I received from Canada a little while since it was said apples were selling at from 2s. to 3s. per barrel, containing 3 bushels. Owing to the heavy crops in different parts of America and England the fruit was so cheap that some did not go to the trouble of picking their crops. The chances are against buyers paying high prices for fruit for export, owing to the low prices prevailing in Europe and America.

Good fruit in this State will, I consider, command favourable prices, and growers in cool districts, who have good keeping varieties of fruits, will do well to store as many as possible for a few months, or until the glut of the fruit has been marketed, when good prices usually prevail.

Raisin and sultana-drying will be in full swing this month, and, as recent advices from Mildura are to the effect that the grape crop has suffered severely from the intense heat and drying winds, the prospects are that the prices of the dried product here should be very good.

The operator should see that the fruit is perfectly ripe before picking it, then dipped in a lye just at boiling point, and made as follows:—1 lb. caustic soda and from 8 to 10 gallons of water. The strength will have to vary according to the toughness of the skin, as it will be found that some of the grapes are much more tender than others. Therefore, it is difficult to set any hard and fast rule for all districts and seasons.

It is best to have a good hot dip with sufficient caustic soda to slightly crack the skins when the fruit is immersed for from one to two seconds.

When put out on trays in the drying ground the fruit must not be exposed to a too severe temperature, but should be stacked up when the thermometer exceeds 100° in the shade. Avôid as far as possible drying in a dusty place, as there is nothing which detracts further from the value of dried fruit as to see dirt and dust mixed through it. This latter applies to all fruits, and the same care should be exercised to keep peaches, prunes, &c., clean while they are exposed during the drying process.

Have all fallen peaches or other fruits destroyed, which might be infected with the fruit fly.

Worthless varieties of fruit-trees may be budded this month.

COLOURED PLATES.

Gravenstein.—Fruit above medium size, roundish, irregular, somewhat angular on the sides. Skin smooth, clear, pale, waxen, yellow streaked, and dotted with crimson, intermixed with orange on the side next the sun. Flesh crisp, white, juicy, with a brisk sub-acid flavour. Stalk about three-quarters of an inch long. Eye large and open, with long segments, set in an irregular basin. Cells round, abaxile Poor keeper. Blossoms early in October, and ripens early in January, except in our very coldest climates, where it comes in several weeks later.

Annie Elizabeth.—Fruit large, round, widest at the base. Skin pale yellow on the shaded side, streaked and spotted on the side next the sun with bright crimson. Eyes, with connivent segments, deeply set in an irregular, angular basin. Stamens median: Tube deep, conical; stalk short, deeply set, frequently with a swelling on one side of it. Flesh white and of firm yet crisp and tender texture, with a fine, brisk, sprightly flavour. Cells obovate, abaxile. An excellent late kitchen or dessert apple.

APPLES
1 GRAVENSTEIN 2 ANNIE ELIZABETH

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of February.

Vegetables.

At time of writing—the middle of January—rain is much needed, not only in the Western districts, but along the coast as well. In some of the districts vegetable production will, doubtless, be difficult, if not impossible, where water is scarce. But rains will most probably fall generally over the country during the month, and then some kinds of vegetables will soon be forthcoming, if the ground be prepared with the surface broken up roughly, so that all the rain that falls upon it will have a good opportunity of soaking in.

Beans, French or Kidney.—This vegetable grows quickly, and quickly produces its pods when it has sufficient moisture, therefore as soon after rain falls as possible sow a good row or two, and the plants will soon yield enough to keep the family going. The dwarf kinds are, taking them all round, the most suitable for farm gardens, but it would be desirable to grow some of the runners. I tried a variety named Carter's Jubilee Runner, a new one to the State, and found it to be excellent. I have only one plant, and it has been very productive, and the beans it yielded are of most delicious flavour. For some time the plant did not bear, and I found its leaves covered with red spider, a minute insect, which attacks the under sides of the leaves in thousands. These little creatures are most destructive, and are generally most prevalent in dry seasons and in dry, sandy soil. Tobacco water sprayed over the leaves will kill them the instant it touches their bodies, but it is a most difficult matter to spray the under sides of such leaves as beans or peas. These insects I find prefer legumes to other plants, and if unchecked will speedily kill peas or beans or prevent them bearing their pods. All old, badly-affected plants should be burnt.

Beet, Silver, stands drought very fairly, and will soon recover and produce good leaves after a fair rainfall. It might be as well to sow a pinch of seed where it can be watered and looked after, and the plants raised may turn out to be very useful for planting out later on ; in the autumn.

Beet, Red.—Wherever the weather has been satisfactory this plant should be available for use, and young plants should be growing satisfactorily. Sow a little seed in a small seed-bed, and by-and-by the young beets raised can be planted out.

Cauliflower.—It is rather important that cauliflower plants should be raised during the month, and it is worth while taking a good

deal of trouble to raise some. After the seed is sown in a seed-bed, this bed should be watered regularly once or twice every day. The seed should be sown in rows, and, after being covered lightly with fine soil, should be covered with some fine dung—say, about half an inch deep, or not quite so much. The bed should be kept shaded during the daytime with a bran bag or old chaff bag, cut open and spread over supports, so as to keep it a foot or 18 inches above the bed. But after the seedlings have come up, and before they become "drawn," remove the shading gradually, and keep them well watered. When well grown—say, 3 or 4 inches in height—prick them out a few inches apart into a bed specially prepared for them, when they will grow strong and hardy for planting out permanently. Use a good deal of good manure for the cauliflower, which needs good feeding. No doubt all this seems to be a good deal of bother and waste of time, for it is much easier to adopt the usual plan of drawing out the long, lanky seedlings from a thickly-sown seed-bed—all legs and no body—and plant them straight away.

Cabbage.—This is the most common and one of the most useful of our vegetables, except the potato; but, taking it all round, it is not grown very satisfactorily. A deal of water and a deal of hard ribs constitutes a vast number of the cabbages grown in Australia. It is frequently so irrigated or watered or grown in such places that the roots are able to reach water-saturated sand, with the results stated above. The ground for the cabbage needs to be well manured frequently with farmyard manure, well rotted. If the dung is applied fresh or half-rotted, or if pig-dung be used, the cabbages will be very coarse, and hardly fit to eat. During the time the cabbages are growing keep on working the soil between them as frequently as you can, not too deep, but just an inch or so on the surface. If seed of the cabbage referred to in these directions some time ago, named Phenomenal, can be obtained, sow it now; and if you take care of the plants, and grow them well, you will find this to be one of the very best cabbages to grow, for, although it attains a very large size, it is soft and tender and of excellent flavour. I gave away a great deal of seed to various growers, who invariably reported the excellence of this variety. I have no more seed left.

Celery.—Keep up a small supply of plants by sowing a little seed now and then. The plants need not occupy much space, even when pricked out, and it is always handy to have a few of these sort of things just ready for planting if required. Recollect that celery requires a good deal of water during its growth—that is, if good, tender leaf-stalks are required. Even when but indifferently grown, celery plants come in useful for cooking—that is, for flavouring soups and those sort of things. The celeriac, or tuberous-rooted celery, is also very useful for the same purpose. Any celery plants which are nearly full-grown can be blanched, either by being earthed up, by the use of boards, old drain-pipes, or anything that will keep away the light from the stems. Earthing up is a troublesome sort of business, and should be out of date, but it is extremely practical, strange to say, considering how laborious the work really is.

Carrots.—Sow a little seed in drills, to keep up a supply. The carrot is, or may be made, a most useful vegetable, and can be cooked in many ways, and it is said to be wholesome and also nourishing, but whether this is the case actually, or whether the consumption of carrots assists the digesting of foods, taken at the same time, I cannot say, but it certainly gives a good flavour to certain kitchen concoctions, and is worth growing for that alone.

Kohl-rabi.—This does not seem to be generally cared for, but a few plants may be useful for a change. Sow a little seed for a trial, and if it is appreciated keep on sowing for succession.

Lettuce.—Sow a row or two where the plants are to grow, for it is very risky to transplant lettuce during the summer time, for then it is likely to bolt off to flower, and seed.

Mustard and Cress.—Sow a little seed occasionally if this is required during the month.

Peas.—A few rows may be sown, but they are only likely to succeed well in the coolest parts of the State. They are hardly worth risking if the weather is at all dry.

Potato.—Try a few rows of Kidney varieties, or, for that matter, other kinds may be tried. Use whole seed, and avoid cutting if possible, or unless the variety you desire to try happens to be a new and expensive one. I made an experiment about four months ago to ascertain how many sets I could raise from one small potato. Mr. Dunnicliff brought me a little Northern Star potato to try. It had three small, shallow eyes, so I divided it into three pieces—at least I cut out each eye with a portion of the tuber around it. I dusted the cut parts with charcoal dust and let them dry for a day, and then planted the sets in a pot. Two of the eyes soon sent up three little shoots each, and the other two shoots. As soon as the leaves were well formed I divided these with a sharp knife, with just a morsel of root each, planted them each in a small pot. They sent up more shoots, and altogether I obtained fourteen good strong sets, and, if it had not been so late in the season, could easily have increased these still further. Potato cuttings, especially if provided with a small heel, will root very soon if kept in a small glass frame, a bell glass, or hand glass. Keep the cuttings moist, but not wet, and *exposed to the light,* but do not let the soil become at all dry. This is easy and interesting work, and could very well be done by neat-fingered girls with but little practice.

Radish.—Sow a little seed now and then during the month.

Savoy.—Sow a little seed and raise strong plants for the winter.

Flowers.

This month will be found rather unsatisfactory for the flowers, unless some good heavy rains fall towards the latter end of January; and the worst of it is all sorts of caterpillars and other pests just seem to perform their greatest damage when the plants are struggling along during the heat and dry weather for a mere existence. It is all very well where one can irrigate, and has quantities of water with which to soak his garden; but, as a rule, this luxury is not too common by any

means during the summer time. But, somehow or other, those persons who really love a garden and plants and flowers can manage to grow something at any time, and anywhere, if it may be even on top of a house in the city.

Annuals belonging to the section known as the cockscomb family, many members of which bear highly ornamental leaves, may be planted if the soil is in a moist enough condition. Other annuals, such as zinneas, Phlox Orummondii, balsams, and portulacas, if planted now, will soon begin to flower, and will keep on flowering until cold weather sets in. A stock of plants can be collected now for the late autumn planting. These should be all evergreens, and the autumn is the best part of the year for planting them out. Bouvardias, Daphnes, fuchsias, palms, ericas, azaleas, carnations, camellias, pines, and conifers of all kinds, and numbers of other plants, may all be planted in the autumn. The deciduous plants should be kept back until they have shed all their leaves in the winter before their planting time arrives.

Chrysanthemums should be watered well if the weather is dry; and grubs, caterpillars, and aphis that may be found attacking the plants should all be destroyed, or there are not likely to be many good flowers.

Dahlias also should be well looked after, watered, and examined for insect pests.

THE DAIRY FARMER AND THE OVER-RUN.

A New Development.

QUITE recently, at a meeting at Berry, the manager of the Coastal Farmers' Co-operative Company, after having first played on the sentimental feelings of his audience, attacked the cream chart published by the Department of Agriculture in a recent issue of the *Gazette*. At present there is neither space nor time to go very fully into this matter, as this issue is going to press to-day, but the following points will be worthy the thoughts and attention of our dairy farmers.

The cream chart in question was published for the express purpose of enabling cream suppliers to calculate the minimum amount of butter which they should be paid for by factories, whether co-operative or proprietary.

The results so far have been highly satisfactory. Many factories in New South Wales and Victoria have already adopted this chart as the basis of payment between them and their suppliers. As already stated, any butter which may be left over after computing payments on this basis should be divided amongst the suppliers in proportion to the amount of butter-fat they supplied. Many farmers have sent me cream for testing purposes to check the factory. These are

welcome, the more that come, the more the farmers show the work is being appreciated. The bottles should always be filled to prevent the cream being churned in transit.

The manager of the company above referred to now claims, unless wrongly reported, that this over-run does not belong to the suppliers! That it can be used to pay for the erection and working expenses of factories.

Let us analyse this new development.

The life and purpose of co-operative dairy factories is that they shall return to the suppliers more than proprietary concerns can or will. This was the reason for the co-operative development in Denmark, in Ireland, and, I believe, in Australia. Certainly the reason why farmers in New South Wales gave their support to co-operative dairies was that they were of opinion the proprietary factories were not paying them for *all* the butter made out of their cream.

There are now some points to consider regarding co-operative factories in New South Wales, viz.:—

(1) Every supplier is not a shareholder.
(2) Every shareholder is not a supplier.
(3) The number of shares held are not in proportion to the amount of cream supplied by each shareholder.
(4) Many suppliers to co-operative factories are tenant farmers with short leases, who may be in Illawarra to-day and on the Richmond River this day twelve months.

For these four reasons, and for many others, any manipulation of tests or withholding of suppliers' money obtained for butter is highly reprehensible and unjust to the suppliers, besides being an injury to the general cause of co-operation.

A very big supplier, a man milking, say, 100 cows, may be a small shareholder, or perhaps not a shareholder at all. At the same time the local banker may be a large shareholder, having taken his shares for business purposes. Why should, say, 10 per cent., perhaps £10 per month, be stopped from the large supplier so as to make the shares of the banker worth 25s. each, when, perhaps, only 10s. has been paid up? For instance, Foley Brothers (butter merchants) are large shareholders in Byron Bay Factory. Should £8 or £10 out of every £100 be *secretly* kept by the factory so as to make these shares more valuable? I do not believe the Byron Bay Company will stoop to this method of finance, even though it may be advocated by the manager of the Coastal Farmers' Co-operative Society.

Other points:—

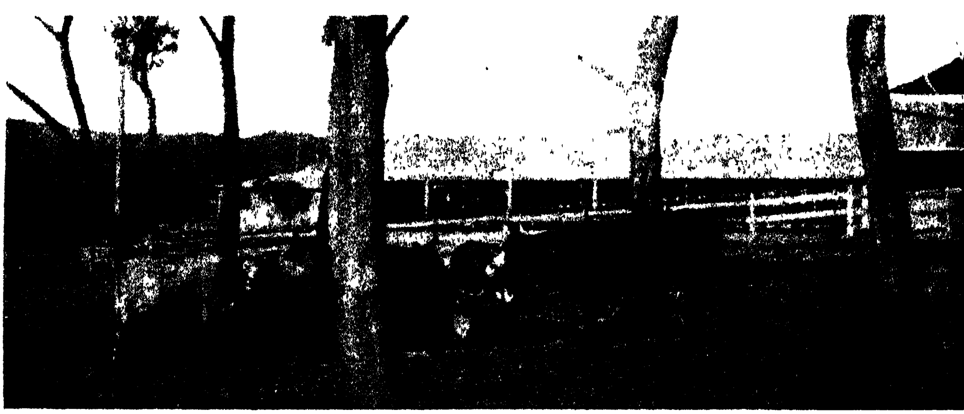
Co-operative factories do not *buy* cream. They do not put a price on the butter-fat in the cream when the farmer delivers it at the factory. These factories simply receive cream on consignment to be made into butter and sold for a certain charge or commission. The farmers are *paid for commercial butter*, and *commercial butter* means butter-fat, plus over-run. If a lump of butter weighing 117½ lb. be analysed, it will, on the average, be found to contain 100 lb. of *butter-fat* and 17½ lb. of over-run.

The over-run is made up of water, salt, curd, a little milk sugar, and sometimes a little preservative. When salt is not added, the amount of water present is always greater.

These are all constituents of commercial butter. If the farmer is paid for commercial butter, how then can any portion of this over-run be legally or morally withheld by the factory. What happens in the British Isles is this:—If a farmer has reason to believe that the factory (co-operative or otherwise) has not paid him in full for the butter value of his milk, he sends a sample to the county analyst, and if the sample turns out good, he sues the factory for the amount which he calculates has been withheld from him, and unless the factory can fall back on a reliable analyst, showing that the milk was of a low butter value, the factory has to pay full value for milk supplied, perhaps for some months previous. No one believes more in the value of co-operative dairying than I. I have served in the cause of co-operative dairying in Ireland, under that able leader, Sir Horace Plunkett, now chief of the Irish Board of Agriculture, but the withholding of any part of the farmers' butter had no part in the programme of Irish co-operative dairying.—M. A. O'Callaghan.

Cattle Eating the Bark of Trees.

Reference has been made to the above subject at various times in the *Agricultural Gazette*, and, although the practice of eating bark indulged in by cattle and horses is not a new one, it has apparently



been on the increase during the last eight or ten years. The period quoted approximately covers the extent of the long drought from which the country is just recovering, and there seems reason to believe that the dry conditions have in many cases assisted in developing the habit.

Recently an interesting example was seen near Manly, at Mr. A. Ralston's Curl Curl dairy farm. Early this year a herd of about thirty cows was placed in a small paddock, and, although well-fed, as their

condition showed, with lucerne hay, bran, corn-meal, &c., they immediately attacked the bark on all the trees, except some Forest Oak (*Casuarina suberosa*), and even these were nibbled slightly near the roots. The species consisted chiefly of Peppermint (*Eucalyptus piperita*), with a little Blackbutt (*E. pilularis*), Swamp Mahogany (*E. robusta*), and the so-called Red Gum (*Angophora lanceolata*). Whether preference was shown for any particular species is not known, but certainly all were treated alike in due course. Some of the Peppermints are up to 4 and 5 feet in diameter, and in several instances the trees are dying from this process of ring-barking. From some trees every vestige of bark has been removed to a height of about 6 feet, as seen in the photograph, the mark of the teeth remaining plainly visible in the sapwood. In one instance a tree of about 3 feet in diameter has been cut down, and all the accessible bark eaten off the trunk and branches just in the same way, only on a very much larger scale, that the rabbits in the Western districts clean the stems of fallen shrubs. An attempt was made to save the trees by tying bagging round the trunks, but these were in most instances absolutely torn off by the cows in their eagerness to get at the bark.

The feature is not uncommon in the suburbs around Sydney, nor in many country places where horses and cattle are kept in small enclosures. During the very dry seasons which have passed many trees have also been barked by stock on extensive runs, the species attacked being often White Box (*Eucalyptus albens*) or Yellow Box (*E. melliodora*), as well as gums and stringybarks. Whatever may be the cause of this acquired taste, from a chemical standpoint, the chief factor, so far as the grazier is concerned, would appear to be the absence of green feed.—R. H. CAMBAGE.

Crown Lands of New South Wales.

THE following areas will be available for selection on and after the dates mentioned:—

FOR SETTLEMENT LEASE

H.S. or S.L. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
			a. r. p.		a. r. p.		£ s. d.	1905.
776	Coonamble..	Bearbong ..	2,390 0 0	1	....	Gilgandra, 13 Dubbo, 50.	44 16 4	16 Mar.
777	Hay........	Gunbar ..	36,730 0 0	5	5,992 0 0 to 8,599 0 0	Gunbar, 3 to 8; Carrathool, 33 to 38.	56 3 6 to 80 12 4	16 ,,
778	Nyngan	Canonba ..	3,443 0 0	1	.... ..	Nyngan, 17.	91 16 4	9 Feb.

FOR IMPROVEMENT LEASE.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
			Central Division.					
			a. r. p.		a. r. p.		£ s. d.	1905.
883, 884, 885, 1262	Moree ..	Terry-Hie-Hie.	7,370 0 0	4	700 0 0 to 3,150 0 0	Moree, 31; Biniguy, 21.	2 18 4 to 26 5 0	Sale, 14 Feb.

FOR CONDITIONAL PURCHASE.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		a. r. p.			£ s. d.	1905.
Albury	Little Billabong and The Falls.	1,280 0 0	Carabost .. .	Goulburn ..	0 11 8	2 Feb.
Armidale ..	....	230 0 0	Yarrowick . .	Sandon ..	1 0 0	9 Mar.
,, ..	....	977 0 0	Never Never ..	Clarke ..	1 0 0	2 ,,
Barmedman ..	.. ..	270 0 0	Mandamah	Bourke ..	0 13 4	23 Feb.
Bathurst ..	....	2,500 0 0	Crete and Baring ...	Westmoreland.	1 0 0	23 Mar.
Bellingen ..	... .	900 0 0	Leigh and Bligh ..	Fitzroy ..	1 0 0	2 Feb.
,, ..	... .	3,500 0 0	Bligh and Fenton..	,, ..	1 3 4	2 ,,
Bingara . ..	Piedmont ..	640 0 0	Capel	Murchison ..	0 10 0	2 ,,
,, ..	,, ...	640 0 0	,, ...	,, ..	1 10 0	2 ,,
Casino	... .	2,500 0 0	Powerpa and Myrtle	Richmond ..	1 0 0	2 Mar.
Cassilis . ..	.. ..	64 0 0	Ulan	Bligh ..	1 10 0	2 Feb.
Condobolin ..	... .	40 0 0	Gulligal	Gipps ..	0 10 0	16 ,,
,, ..	. . . .	270 0 0	,, ...	,, ..	0 12 6	16 ,,
Coonamble ..	Tonderburine ..	690 0 0	Tonderbrine ..	Gowen ..	2 0 0	23 Mar.
,, ..	,, ..	477 0 0	,, ...	,, ..	1 5 0	23 ,,
,, ..	,, ..	998 1 0	Cobbinbil	,, ..	1 7 6	23 ,,
Cootamundry ..	.. ..	420 0 0	Cunjegong	Harden ..	0 5 0	23 Feb.
,, ..	....	200 0 0	,, ...	,, ..	0 6 8	23 ,,
,, ..	.... .	400 0 0	,, and Cowcumbla.	,, ..	0 8 4	23 ,,
,, ..	....	70 0 0	Cunjegong and Cowcumbla.	,, ..	0 13 4	23 ,,

For Conditional Purchase—*continued.*

Land District.	Name of Holding, &c.	Total Area. a. r. p.	Parish.	County.	Price per Acre. £ s. d.	Date available. 1905.
Deniliquin	Woorooma	385 0 0	Benjee	Wakool	1 0 0	16 Mar.
Dubbo	Terramungamine	171 0 0	Coolbaggie	Lincoln	1 15 0	9 Feb.
Eden	....	150 0 0	Genoa	Auckland	1 0 0	16 Mar.
Glen Innes	....	130 0 0	Severn	Gough	1 0 0	2 ,,
Gundagai	Yabtree	300 0 0	Yaven	Wynyard	1 15 0	9 ,,
,,	....	100 0 0	Cooba	Clarendon	1 10 0	23 ,,
,,	....	97 0 0	,,	,,	2 0 0	23 ,,
Gunnedah	....	910 0 0	Black Jack	Pottinger	0 18 4	16 ,,
,,	....	179 0 0	,,	,,	1 3 4	16 ,,
Hay	Gunbar	22,569 3 0	Gonowlia, Bowerabine, Belaly, &c.	Nicholson	0 15 0	16 ,,
Hillston	....	1,157 2 0	Lachlan	Dowling	0 10 0	16 ,,
,,	Uabba and Wooyeo (partly)	56,000 0 0	Ulambong, Yelkin, Lachlan, &c.	,,	1 0 0	26 Jan.
Kempsey	....	700 0 0	Denison	Raleigh	1 0 0	16 Mar.
Lismore	....	370 3 0	Jiggi	Rous	1 0 0	16 ,,
Lithgow	....	263 0 0	Falnash	Cook	0 13 4	23 Feb.
,,	....	219 2 0	Lett	,,	0 18 4	23 ,,
Molong	....	820 0 0	Goimbla	Ashburnham	1 0 0	16 Mar.
,,	....	422 3 0	Brymedura & Bell	,,	0 8 4	2 Feb.
,,	Buckinbah	2,280 0 0	Cotombal	Gordon	0 10 0	2 ,,
,,	....	700 0 0	The Gap	,,	0 11 8	2 ,,
Narrabri	Centre Block, No. 3	7,344 0 0	Oreel	Jamison	1 10 0	9 Mar.
Orange	....	1,388 0 0	Larras Lake	Wellington	0 10 0	2 Feb.
,,	....	1,380 0 0	Mulyan	,,	0 10 0	2 ,,
,,	....	40 0 0	Larras Lake	,,	0 13 4	2 ,,
Parkes	....	275 0 0	Martin	Ashburnham	1 10 0	16 Mar.
,,	....	4,000 0 0	Redcliffe	Kendedy, Cunningham	0 13 4	23 ,,
Raymond Ter'ace	....	40 0 0	Thornton	Gloucester	0 11 8	9 Feb.
Tamworth	Wombramurra	670 0 0	Wombramurra	Parry	0 10 0	9 ,,
,,	Moonbi	109 0 0	Moonbi	Inglis	0 10 0	16 Mar.
,,	North Barraba	700 0 0	Tiabundie	Darling	1 0 0	16 ,,
Tenterfield	Tenterfield and Boura Boura Creek	320 0 0	Boonoo Boonoo	Buller	0 13 4	23 ,,
Tumbarumba	Jingellic	640 0 0	Jingellic	Goulburn	0 8 4	9 Feb.
Tumberumba North	....	875 0 0	Wood	Wynyard	0 6 8	23 ,,
,,	....	2,010 0 0	..	,,	0 8 4	23 ,,
Tumut	Oberne	125 0 0	Hillas	,,	0 18 4	16 Mar,
Wagga Wagga	Murrulebale	140 0 0	Lachlan	Bourke	1 10 0	9 Feb.
Warialda	Gournama	2,140 0 0	Gournama	Burnett	1 10 0	9 ,,

Special Areas.

Lismore Land District, in parish Byron, county Rous; 16 acres 2 roods 30 perches in one portion; maximum and minimum area, 16 acres 2 roods 30 perches: within Byron Bay suburban area; price, £5 per acre. Available 16th February, 1905.

Murwillumbah Land District, in parish Murwillumbah, county Rous, 166 acres in one portion; maximum area, 166 acres; minimum area, 40 acres; distant 10 miles from Murwillumbah; price, £3 per acre, Available 16th March, 1905.

Murwillumbah Land District, in parish Mullumbimby, county Rous; 65 acres in one portion; maximum and minimum area, 65 acres: distant 4½ miles from Mullumbimby; price, £10 per acre. Available 16th March, 1905.

Murwillumbah Land District, 98¾ acres, in parish Brunswick, county Rous; maximum area, 98¾ acres, minimum area, 40 acres; price, £5 per acre; distant 6 miles from Byron Bay. Available 9th March, 1905,

Murwillumbah Land District, 40 acres, in parish Brunswick, county Rous; maximum and minimum area, 40 acres; price, £5 per acre; distant 7¼ miles from Byron Bay and 1 mile from Tyagarah Railway Station. Available 9th March, 1905.

(Signed) EDWARD MACFARLANE,
Under Secretary for Lands.

AGRICULTURAL SOCIETIES' SHOWS.

1905.

Society.	Secretary.	Date.
Berry Agricultural Association	A. J. Colley	Feb. 1, 2, 3
Moruya A. and P. Society	J. Jeffery	,, 8, 9
Wollongong A. and H. Society	J. A. Beatson	,, 9, 10, 11
Alstonville A. Society	F. H. Bartlett	,, 14, 15
Ulladulla A. and H. Association	Jos. Kendall	,, 15, 16
Lithgow A., H., and P. Society	H. N. Jolliffe	,, 15, 16
Manning River A. and H. Association	S. Whitbread	,, 16, 17
Southern New England (Uralla) P. and A. Association	R. Mackay	,, 21, 22
Tumut A. and P. Association	E. H. Vyner	,, 22, 23
Candelo A. and H. Association	C. H. Brooks	,, 23, 24
Lismore A. and T. Society	T. M. Hewitt	Mar. 1, 2
Liverpool Plains (Tamworth) P., A., and H. Association	J. R. Wood	,, 1, 2
Robertson A. and H. Society	R. J. Ferguson	,, 2, 3
Port Macquarie and Hastings District A. and H. Society	J. Y. Butler	,, 2, 3
Bombala Exhibition Society	W. G. Tweedie	,, 7, 8
Tenterfield Intercolonial A. and M. Society	F. W. Hoskin	,, 7, 8, 9
Fair Days	....	,, 10, 11
Barraba P., A., and H. Association	J. W. Bull	,, 8, 9, 10
Nepean District A., H., and I. Society	E. K. Waldron	,, 9, 10
Oberon A., H., and P. Association	W. Minehan	,, 9, 10
Berrima District Agricultural Show	Geo. Yeo	,, 9, 10, 11
Gulgong P. and A. Association	G. E. Hilton	,, 14, 15
Central New England (Glen Innes) P., A., and M. Society	Geo. A. Priest	,, 14, 15, 16
Campbelltown A., H., and I. Society	A. R. Payten	,, 14, 15, 16
Macleay A. and H. Association (Kempsey)	E. Weeks	,, 15, 16, 17
Newcastle and District A., H., and P. Association	M. A. Fraser	,, 16, 17, 18
Goulburn A., P., and H. Society	J. J. Roberts	,, 16, 17, 1
Cumnock P., A., and H. Association	W. L. Ross	,, 17
Blayney A. and P. Association	H. R. Woolley	,, 21, 22
Gundagai P. and A. Association	A. Elworthy	,, 21, 22
Warialda P. and A. Association	W. B. Geddes	,, 22, 23
Mudgee Agricultural Society	J. M. Cox	,, 21, 22, 23
Camden A., H., and I. Association	C. A. Thompson	,, 22, 23, 24
Crookwell A., P., and H. Society	C. T. Clifton	,, 23, 24
Wellington P., A., and H. Society	A. E. Rotton	,, 28, 29, 30
Namoi P., A., and H. Association (Narrabri)	J. McCutcheon	,, 28, 29, 30
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Hunter River A. and H. Association (West Maitland)	C. J. H. King	April 4, 5, 6, 7
Quirindi District P., A., and H. Association	Will. Cadell	,, 5, 6
Clarence P. and A. Society	Jas. C. Wilcox	,, 5, 6
Bathurst A., H., and P. Association	W. G. Thompson	,, 5, 6, 7
Upper Manning A. and H. Association (Wingham)	W. Dimond	,, 6, 7
Lower Clarence Agricultural Society (Maclean)	Geo. Davis	,, 11, 12
Orange A. and P. Association	W. Tanner	,, 12, 13, 14
Cooma P. and A. Association	C. J. Walmsley	,, 12, 13
Richmond River (Casino) A., H., and P. Society	E. J. Robinson	,, 12, 13
Royal Agricultural Society of New South Wales	F. Webster	,, 19 to 27
Dungog A. and H. Association	Chas. E. Grant	May 3, 4
Moree P. and A. Society	S. L. Cohen	,, 10, 11
Hawkesbury District (Richmond) A. Association	C. S. Guest	,, 12, 13, 14
Walgett P. and A. Association	Thos. Clarke	,, 17, 18
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[2 plates.]

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Agricultural Gazette of New South Wales.

The Tapeworms of Australia.

(Continued from page 168.)

N. A. COBB.

THE tapeworms examined by the writer from various domesticated and wild animals in Australia will now be described. The arrangement considered most suitable to the pages of this journal is an arrangement according to the hosts, and consequently we shall begin with the carnivorous animals and proceed downward through the vertebrata to the fishes and lower groups.

At the end of the work it is proposed to devote some pages to a systematic arrangement of the various species of tapeworms, and to keys that will enable the scientific student to expeditiously consult the work.

In the very tedious work of collecting the considerable number of tapeworms now to be described, I have to acknowledge the assistance of a large number of persons. I wish to mention particularly my colleagues, Messrs. R. Helms and E. M. Grosse, to whose assiduous work at all times of day and night much of the value of the collection is due. Mr. Sydney Jackson, at the expense of much careful labour, secured several species found in the birds, particulary those of our Northern Rivers. To Dr. Hill, of Sydney University, I am indebted for specimens, more particularly from marine birds. Mr. A. R. Crawford has kindly forwarded me from time to time specimens from the various marsupials of his neighbourhood. The various Inspectors of Stock in different parts of New South Wales have furnished specimens of the tapeworms found in sheep, cattle, and horses, as well as in wallaby and kangaroo. Mr. W. Perrie, of Surry Hills, has made a large collection of parasites from the Abattoirs of Sydney and in his veterinary practice, and among his specimens are a number of tapeworms that have been useful in adding to our knowledge of the Sydney parasitic fauna of most of our domestic animals. Mr. A. M. Lea, Government Entomologist of Tasmania, has, from time to time, sent me valuable specimens of this class.

To a large number of correspondents in all parts of Australia I am indebted for material and information.

I have in all cases preferred to describe the material collected by myself, or under my immediate personal supervision, supplementing it with other material where necessary. Where the description rests on material collected by another, the name of the collector is appended.

Through the enlightened action of the Hon. the Minister for Lands of the State of New South Wales, I have been permitted to collect for scientific purposes the animals and birds protected by law in that State.

All the illustrations are original, and are derived from Australian specimens only.

Tapeworms of the Cat (*Felis domesticus*, Briss.).

The cat in Australia is very frequently the host of one of two tapeworms, *Dipylidium ellipticum* and *Taenia crassicollis*, both of which are well-known species. The majority of the cats examined contained one or more worms, but the number was never great. It was uncommon to find more than half-a-dozen worms in one cat. I have also observed a single specimen of *Dibothriocephalus* in a Sydney cat.

It has been said that these various tapeworms are harmless to the cat, but I am inclined to think that, however harmless the *Dipylidium ellipticum* may be, the *Taenia crassicollis* is an injurious parasite. Emaciated cats, infested with this worm, but with no other assignable disease, appear to be common. Worms with such a powerful cephalic armature as that of *T. crassicollis* are quite capable of perforating the intestine, and I have seen a case in which it appeared not improbable that this had occurred in a cat.

Nevertheless, Australian cats do not appear to suffer so much from these various parasites as do those of Europe, where the proportion of cats infested is higher, and the number of worms per cat much greater. As many as 600 tapeworms have been found in one cat, and 50 is a common number. I believe no such severe infestation has ever been observed in Australia.

The intermediate hosts of the *Taenia crassicollis* are the rat and the mouse, and a few other related rodents, while those of the *Dipylidium ellipticum* are most probably the flea and the louse, as is the case with the very closely-related (identical ?) tapeworm of the dog. The intermediate host of the *Dibothriocephalus* noted is unknown, but as the cysts of this genus are known only in fishes, it is a fair presumption that the intermediate host is in this case also a fish.

As with all other domesticated animals, so with the cat, a most important question is the relation between its parasites and those of man. Fortunately, the cat, so far as its internal parasites are concerned comes out from this scrutiny with a comparatively good record. The *Dipylidium ellipticum*, or, at any rate, the *Dipylidium caninum* of the dog, which is a very closely-related species indeed, is not an uncommon denizen of the intestines of babes and young children in some parts of Europe, but there are no such cases recorded for Australia. I am not aware that any serious consequences have ever been attributed to its presence in human beings. The cat has been more than suspected of harbouring the *Dibothriocephalus latus*, or broad tapeworm of man, but the evidence is not altogether satisfactory, and in any case the occurrence of this tapeworm in the cat is very rare. Whether the *Dibothriocephalus* noted by me in a Sydney cat has

any relation to man must remain an open question, though it may be taken as proved that it is not a specimen of *D. latus* of man.

It will be seen that the various tapeworms of the cat are readily distinguished one from another. The illustrations given herewith make the determination of the various species both easy and certain. The figures of the eggs are carefully prepared, and they may be used in diagnoses, especially that of the species of *Dibothriocephalus*. Species of this genus, it is well known, produce eggs while in the host, and these eggs appear in large numbers in the excreta, and serve not only to establish the verminous infestation, but also to identify the species.

1. *Dipylidium ellipticum*, Butsch.—It is possible that this is the commonest tapeworm of the cat in this country. Among my collections I find more cases of it than of any other species, though the *Taenia crassicollis*, I feel fairly sure, is almost as common, at any rate in the neighbourhood of Sydney. It may be that the prevalence of rats along the harbour shores has something to do with this abundance of *T. crassicollis*. Most of my collections of *T. crassicollis* were made before the advent of the plague. It may be that the war waged against the rat of late years will have had a decided effect on the prevalence of *T. crassicollis*. It would be interesting to compare the present frequency with that of ante-bubonic days, but I have not sufficient data for that purpose.

Fig. 4.—Tapeworm of the Domestic Cat. *(Dipylidium ellipticum.)* Natural Size.

The worms are from 50 to 200 mm. long, worms of 50 mm. yielding perfectly mature eggs. The greatest width noted is about 4 mm., though the width usually varies between 1·3 and 3·8 mm. The larger measurements are from a specimen not collected by myself, and I suspect that the excessive width is due to some peculiarity of the process of preservation—perhaps to incipient maceration. The usual range is from 1·3 to 1·7 mm. The somewhat quadrate head is twice as wide as the neck, and bears four well-developed unarmed suckers, about 200μ across, and facing outward. There is a well-developed rostellum, upon which the small rose-thorn-shaped hooklets, 18μ long, are arranged in four rather irregular rows, one above another.

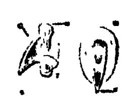


Fig. 5.—Two views of the hooklets of the *Dipylidium ellipticum* **of the Domestic Cat.**

C, side view; E, end view; *x*, point of the hooklet; *y*, distal process for the attachment of muscle; *z*, proximal process for the attachment of muscle. ×, 500.

Measurements in different parts of the body showed various segments to have the following dimensions:—Neck, ·3–·4; testicular, 1·3–2·5 x 1·5–4·2; ripe, 1·3–3·8 x 6·8–8·5 mm. As will be seen (Fig. 4), the riper segments take on a peculiar appearance, suggesting the links of a watch-chain or a row of cucumber seeds. The sexual pores are to be seen on each side of each segment. Often they may be seen with the unaided eye, and they are always readily made out with a lens. They are near the middle of the margin of the segment.

The eggs are contained in spherical to ellipsoidal thin-walled

capsules, measuring 72–200 x 112–220μ, and containing, according to their size, six to thirty-five spherical eggs 40–52μ in diameter, averaging about 46μ. The eggs are thin-shelled, and contain fully-developed spherical embryos, having six hooklets 12 to 16μ long. The embryos are 30–40μ in diameter, averaging 36μ.

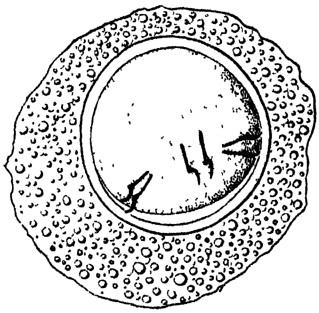


Fig. 6.—Egg of the *Dipylidium ellipticum* of the Domestic Cat, with its enclosing capsule and its enclosed six-hooked embryo.
From a spirit specimen. × 700.

A segment may hold upwards of 350 capsules, averaging twenty-three eggs each, and hence contain in all some 8,000 eggs.

I am not aware that this tapeworm has been experimented with so fully as the corresponding parasite of the dog, the *Dipylidium caninum*. It is well established that the intermediate host for the *Dipylidium caninum* is the flea, and more rarely the louse, of the dog. We may well believe then that the intermediate host of the corresponding tapeworm of the cat is the flea, which is an extremely common parasite on Australian cats.

This is all the more permissible as the two tapeworms are so nearly allied that it has been a moot question whether they are not one and the same species. The supposition is supported by the rarity with us of other external insect parasites of the cat.

Segments of these tapeworms may occasionally be seen clinging to the hair near the anus. They appear to have a considerable power of locomotion, though I would hesitate to call their progression "crawling." The eggs, hundreds from each ripe segment, are laid soon after the segments reach the open air, and become distributed on the hair, especially near the anus. Thence they have been supposed by some to find their way direct into the intermediate host, the flea. It may be that the larvæ of the flea play a more important part than has yet been demonstrated. The known facts are given under the head of the corresponding parasite of the dog, the *Dipylidium caninum*.

Habitat.—Small intestine of the cat, various parts of N.S.W.

2. *Taenia crassicollis*, Rud.—This tapeworm is very common in cats in Australia, at any rate in and around Sydney. Lank and lean cats are not infrequently found to be suffering from its attacks. I do not think, however, that extreme cases of the disease can be common. The cat acquires this tapeworm from rats, mice, and related rodents, where the cystic stage occurs in the liver.

Fig. 7.—Tapeworm of the Domestic Cat. (*Taenia crassicollis.*)
Natural size.

The worm is from 150 to 600 mm. long. My largest Australian specimen is 215 mm. long, and consists of about 180 segments. The head is little if any wider than the neck, and is not set off by any constriction. There are four projecting

suckers, as is shown in the illustration, and in front of these a low, broad, powerful rostellum, bearing two rows of hooklets, usually 17 or 18 in each row, most often 17. These hooklets are usually dark in colour, and of unequal size. On comparing my notes on Australian specimens, collected during fifteen years, I find the number varies from 32 to 38, but is nearly always 34 or 36, most often 34.

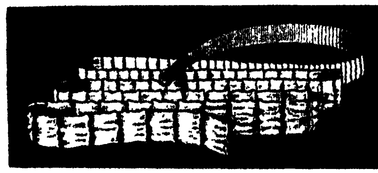


Fig. 8.—Tapeworm of the Domestic Cat.
(*Taenia crassicollis.*)
Natural size.

The various segments on my largest specimen have dimensions as follows:—Neck, 1·7; testicular, 4·6 x 2·1; ripe, 4·2 x 4·2 mm. Other observers have seen segments 5–6 x 8–10 mm. The margin is serrate, coarsely so at length. The worms are rather thin and ribbon-like. The genital pores are irregularly arranged, occurring on both margins of the worm, one pore to each segment. A broad, low, elevation near the middle of the margin of the segment indicates the position of this pore. Each ripe segment contains about 40,000 rather thick-shelled (4μ) spherical eggs, 36μ. in diameter, each containing a fully-developed embryo, 20 x 24μ., bearing six hooklets 6–8μ. long.

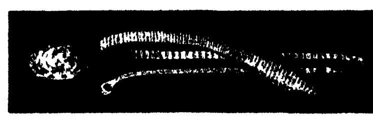


Fig. 9.—Cyst of the *Taenia crassicollis* of the Cat, as removed from the liver of a rat.

We have already noted that this worm passes its intermediate stage in members of the rat tribe, forming

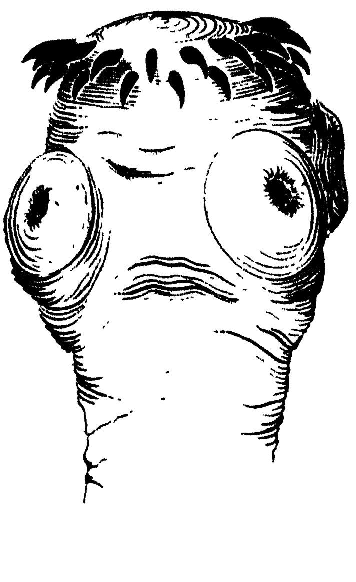


Fig. 10.—Tapeworm of the Domestic Cat.
(*Taenia crassicollis.*)

The drawing shows the lateral view of the scolex or "head." The dorso-ventral view of the same scolex is shown in Fig. 11,

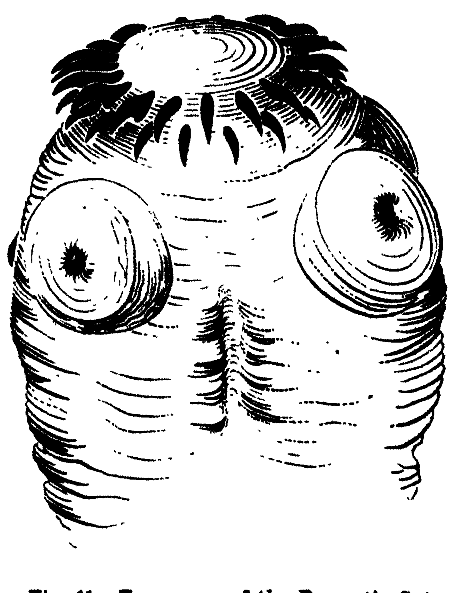


Fig. 11.—Tapeworm of the Domestic Cat.
(*Taenia crassicollis.*)

Dorso-ventral view of the same scolex or "head" as that shown in Fig. 10. × 32.

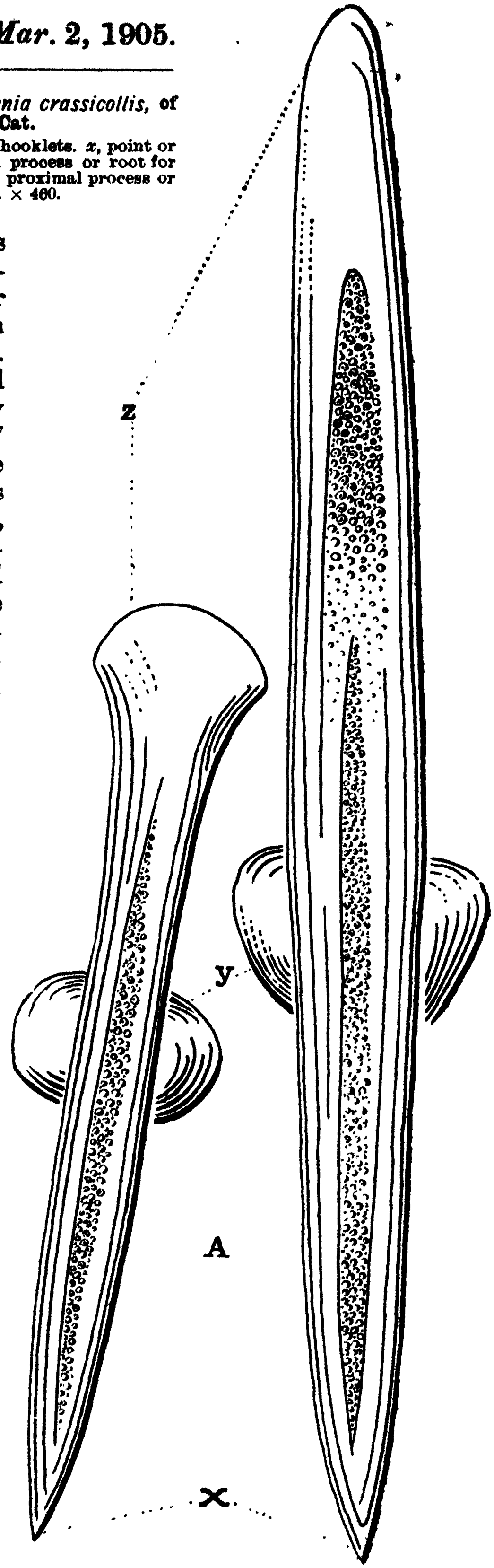


Fig. 12.—Hooklets of the *Taenia crassicollis*, of the Domestic Cat.

Front view of two adjacent hooklets. *x*, point or apex of the hooklets; *y*, distal process or root for the attachment of muscle; *z*, proximal process or root for attachment of muscle. × 460.

cysts in the liver. These cysts are striking objects when dissected out, their light colour forming a strong contrast with the dark colour of the liver. One of these cysts is illustrated in Fig. 9. They are usually spherical, and about 6 to 7 millimetres in diameter. The cysticercus removed from this cyst is a remarkable creature, in that it is already a segmented growth. The head appears precisely as in the tapeworm found in the intestine of the cat. This cysticercus is also shown natural size in Fig. 9. It is 90 mm. long and 3·5 mm. wide in its widest part, which is toward the posterior extremity. If these cysts be fed to cats, they promptly develop into *T. crassicollis*. On the other hand, if the segments of the tapeworm thus produced be fed to rats, they are prompty infested with the cysts in the liver.

As before remarked, this worm is a not uncommon denizen of emaciated cats in Sydney, and is probably the cause of considerable disease and mortality. The following extract is from Neumann's "Parasites and Parasitic Diseases of Domesticated Animals," and shows that this worm may be the cause of much mortality on occasions:—

"This *Taenia* is common in the small intestine of the cat, and it may, when numerous, occasion serious disease. Romano has published the

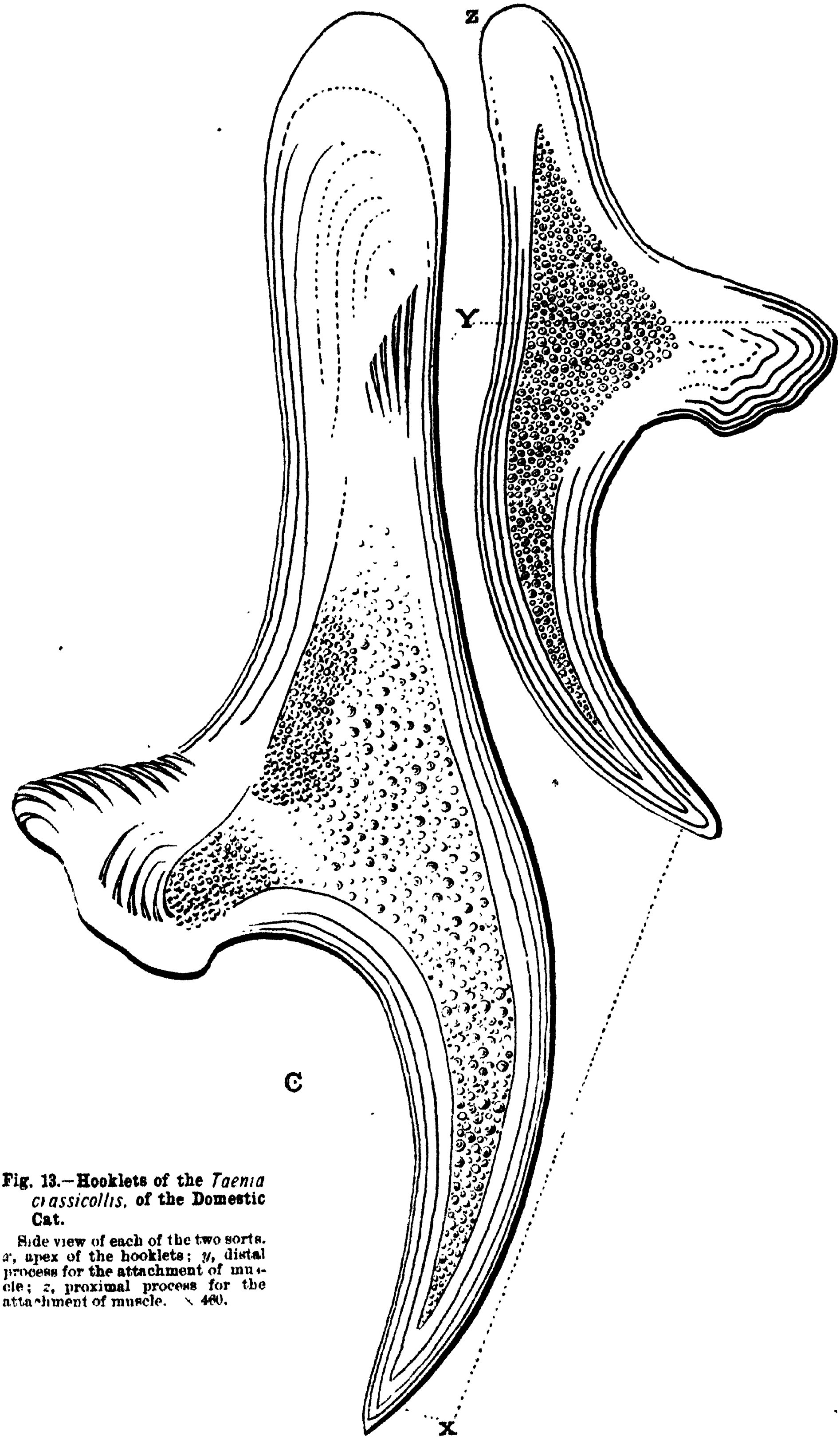


Fig. 13.—Hooklets of the *Taenia crassicollis*, of the Domestic Cat.

Side view of each of the two sorts. *x*, apex of the hooklets; *y*, distal process for the attachment of muscle; *z*, proximal process for the attachment of muscle. × 460.

account of an epizooty among Cats caused by this tapeworm. The animals died after showing the following symptoms: 'Gradual diminution, then complete loss, of appetite; abdomen retracted; slight diarrhœa at the commencement, then constipation; abundant salivation; sometimes spasmodic contraction of the muscles of the upper lip; great prostration, and loss of sight.' Some of the animals could not hear, or appeared not to hear, the voice of the people to whom they were accustomed; certain of them vomited, and this seemed to give them slight but temporary relief. Nervous phenomena, epileptiform convulsions, and more frequently attacks of colic, were also remarked. A similar epizooty prevailed among cats in the Black Forest in 1874.

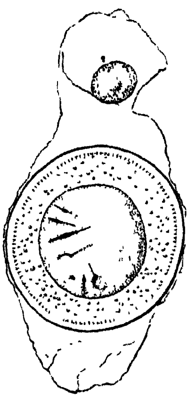


Fig. 14.—Egg of the *Taenia crassicollis* of the Domestic Cat.

The spherical egg is enclosed in a capsule, and itself encloses an embryo supplied with three pairs of hooklets. From a spirit specimen. × 700.

"At the autopsy of the animals which had succumbed, there were found—along with *Taeniae*, extending from the stomach to the middle of the small intestine—evidence of chronic enteritis and a violent gastric catarrh. The hooks of the worms were deeply implanted in the mucous membrane.

"Perroncito was inclined to attribute a rupture of the intestinal wall he found in a cat to the action of *T. crassicollis*, and Grassi and Parona have witnessed an analogous case; while Zschokke also considers this entozoon as a frequent cause of death among cats.

"The cat contracts the *T. crassicollis* in eating rats or mice which harbour the *Cysticercus fasciolaris* in their liver. In Romano's observations, the cats he alludes to had to encounter swarms of rats, which were unusually numerous that year; and it was those which were the best 'ratters' that succumbed to the epizooty."

Habitat.—Small intestine of the cat, Sydney, N.S.W.

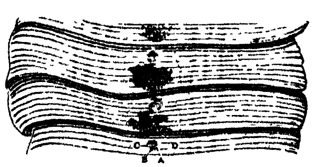


Fig. 15.—A few segments of the *Dibothriocephalus* of the Domestic Cat, as referred to in the text.

A, opening leading to the vagina and cirrhus pouch; B, uterine open ing; C, the cirrhus pouch seen behind the openings; D, the uterus filled with eggs. These features are seen repeated in the successive segments.

3. *Dibothriocephalus felis*, Crep.—I have seen only a single specimen of this tapeworm, which I observed with several *Ascaris mystax* in the intestine of a two-year old cat that had begun to show signs of some internal complaint. The worm was found in the small intestine. Its 370 segments made up a total length of 270 mm. The greatest width was 5·5 mm., this being the width of the final segment. Segments in the various parts of the body gave the following measurements:—Neck, (?); testicular, ·9 x 5·5; ripe, 1·3 x 5·5 mm. The worm was decidedly thin and ribbon-like, and the segments were so joined together as to give to the contour a faint serration. Down the middle

of one face of the worm was a row of genital pores, two to each segment, one of which, the larger and foremost, is the common outlet for the cirrhus and vagina, while the other is the uterine pore. These pores, which form a striking feature of the worm, occur on the middle line of the worm on each segment near the junction of the anterior and second fourths of the length of the segment.

No head was obtained with this specimen, so that it is impossible to give the details of that part of the anatomy. The smallest segment recovered measured ·37 mm. long by 1·25 mm. wide by ·25 mm. thick, and could not have been very far removed from the head. At about the 100th segment from the above-mentioned smallest segment, perfect eggs began to appear in the segments, and from thence onward eggs were abundant, so that from 250 to 300 of the segments were sexually ripe and productive. The 200th segment was well nigh as fully supplied with fully-prepared eggs as the final, so that I have little doubt that the entire colony contained 200,000 eggs. The segments at the time they first begin to produce eggs are ·62 mm. long by 3·75 mm. wide by ·38 mm. thick.

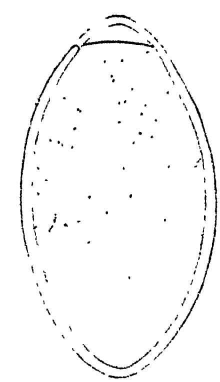


Fig. 16.—Egg of the *Dibothriocephalus* of the Domestic Cat, as mentioned in the text.

The egg opens at one end by means of a lid, thus facilitating the escape of the embryo. Several pores are shown as existing in the lid. From a spirit specimen. × 700.

The pore acting as the outlet for the cirrhus and the vagina is a transverse slit about ·25 mm. wide. Almost immediately behind it is the uterine pore, much smaller. Extending inward and forward in a dorso-ventral plane is the cirrhus pouch, which is about as wide as the common opening for the cirrhus and vagina. On being dissected out, the uterus is not plainly rosette-shaped, and the coils are few and placed so close together that the full width of the uterus is not over 1 mm. The length also is not much over 1 mm.

The testicles, ellipsoidal collections of cells 125μ in their greatest diameter (which is placed transversely), are located exclusively in the core of the segment. They extend from the very margin of the segment to the middle line, except in so far as they are prevented from doing so by the presence of the uterus. In a mature segment I counted 450 of them.

The cirrhus pouch is a flattish ellipsoidal sack about ·3 mm. wide, and somewhat wider than long.

The yolk follicles are distributed rather evenly immediately under the cuticle, and outside the longitudinal musculature. The follicles are much smaller than the testicles, and extend from the margin of the segment to near the middle line.

The uterus is composed of few winds or bends, and these are so compactly grouped that there is no appearance of a rosette, as in many species of this genus. Measuring transversely, the middle seventh of the segment is occupied by the fully-developed uterus. It lies in the posterior half or two-thirds of the segment, or better, in the two

posterior of the three middle fifths. Those eggs, from one-third to one-fifth of the whole, speaking approximately, that are in the anterior part of the uterus, that is to say, the oldest of the eggs, possess shells of a much more impervious character than those of the remainder, showing that the formation of the shell changes in character while the egg is in the uterus. The evidence of this is the relative action on the eggs in the various parts of the uterus of clearing fluids such as carbolic acid.

The pores that exist in the cirrhus-vagina atrium in some species of *Dibothriocephalus* are not a prominent feature in this species; in fact, I have not seen any satisfactory traces of them.

The ellipsoidal, or, in some aspects, faintly fusiform, slightly unsymmetrical, eggs, rather thin-shelled ($1{\cdot}5\mu$), to the number of about 1,000 in each segment, measure, when fixed with hot sublimate and preserved in alcohol, 36-40 x 64-74 μ, averaging 37 x 70 μ. These eggs are supplied with a lid.

Without further information, it seems to me impossible to satisfactorily classify this specimen. It agrees fairly well with the descriptions of the species of Creplin in some respects, but there are some interesting differences. It may be supposed that the intermediate host of this worm was a fish, that being the usual intermediate host for a *Dibothriocephalus*. The cat from which the worm was taken had been often fed on the raw remnants of salt-water fish. It is very unlikely that it ever ate a fresh-water fish.

Habitat.—Small intestine of the cat. Sydney, N.S.W.

The members of the *Bothriocephalidae* that have been found parasitic in the domestic cat have been the subject of much discussion because of their possible relation to man. More than one author has suggested that the *Dibothriocephalus* of man occurs in the cat, and on several occasions competent authorities have examined specimens from the cat that appeared to them to support that opinion. It is therefore interesting to compare the Sydney specimen with the parasite of man and with other records of related parasites hitherto found in the cat.

As regards size, the Sydney specimen is much smaller than the average of *D. latus* of man, and it would seem to be even below the smallest recorded mature specimens of that tapeworm. The human parasite reaches 8 to 9 metres, and the smallest specimens are about 2 metres long. Our specimen is only about one-quarter of a metre long, though a portion of indefinite length is missing. The missing portion however cannot have been more than a few millimetres long, so that it is quite safe to put the length as under one-third of a metre; as to breadth the differences are not so great. The human worm averages 10 to 12 millimetres, while that of the specimen under consideration is only about 5 millimetres. However, there are records of the human parasite being as narrow as 5 millimetres.

The eggs of *D. latus*, the human parasite, measure on the average 35 x 50 μ, those of the worm of the Sydney cat 37 x 70 μ,—a very considerable difference. Moreover, the eggs of the Sydney specimen are more pointed and unsymmetrical than those of *D. latus*. Again, the uterus of *D. latus* occurs in the form of a rosette, about

one-fourth of the width of the segment. In our specimen there is no distinct formation of a rosette, and only one-seventh of the width is taken up by the uterus. As regards the male elements, while the number of testicular follicles is variously given in *D. latus* as from 320 to 1,200, and most reliably it would seem at 600 to 700, the number in the species before us is 450, the follicles being themselves only 10 per cent. less in diameter than that given for *D. latus*.

As to the number of proglottids there is a wide difference, those of our specimen numbering only hundreds where those of *D. latus* number thousands.

The known intermediate hosts of *D. latus* are all, I believe, fresh-water fishes. Although it is possible, it is in a high degree improbable that the Sydney cat ever tasted fresh-water fish. During the life of the cat, the family to which it belonged never consumed any fresh-water fish. If the cat procured any such food, it would be by foraging; it was well fed, and had little occasion to forage. In any case, fresh-water fish would be most uncommon food in the neighbourhood. From this it will be seen how improbable it is that the cat would have had an opportunity to infest itself from any fresh-water fish, let alone the particular species known to harbour the necessary cysts.

It seems clear that, on all grounds, we must regard the species we have described as distinct from *Dibothriocephalus latus*, the human parasite.

(*To be continued.*)

Dressing Wounds on Sheep.

For clean cuts a good dressing to prevent the fly from settling on the wound is a mixture of 1 part turpentine, 1 part Stockholm tar, and 2 parts salad or olive oil.

The turpentine is cleansing, and its strong smell keeps the flies off; but being very volatile it would soon evaporate if used alone.

Tar is healing, and being strong-smelling is objectionable to the fly. It also adheres to the wool and flesh, and assists to retain the turpentine.

Salad or olive oil tends to soften the severe effects of the tar and turps, also to a great extent prevents the tar from injuring the wool.

The same mixture is also very effective in destroying the maggots after the sheep are blown, and in healing the wounds made by them. Any lubricating oil or ordinary fat would serve as a substitute to mix with the tar and turps.—C. J. Crocker, Inspector of Stock, Mudgee.

The Settler's Guide.

[Continued from Page 184].

ROBERT KALESKI,
Bulli Range, Liverpool.

In connection with the paragraph dealing with axes, which appeared in last issue, page 169, the following statements were inadvertently omitted :—

In replacing a handle, do not burn the broken piece out, as this spoils the temper of the steel. It is much better to bore the wedge out and then knock out the broken piece with a piece of wood. If wedged in with iron, as some foolish people do, get it out the best way you can. In putting in a new handle, trim the head down so that the heel of the eye is almost down to the shoulder, if otherwise, the axe is awkward to use, and wastes much power. Also be careful that the axe-head is fixed square-on, or you will be cutting with the top or heel of the edge, instead of the blade.

To sharpen an axe.—Please remember that in sharpening all edge tools, the whole art of it may be said in four words. These words are "keeping a true bevel." What is meant by that ? This, that all tool edges consist of two parts, the cutting line, at the edge, and the shoulder, which is the slope or bevel between the cutting edge and the other parallel edge. Having the correct bevel is of such importance for this reason, that when an edge tool enters wood it depends entirely on the bevel or shoulder, as to whether the tool shall work easily or hard, properly or not, and the cutting-edge shall remain sharp. Almost all edge tools enter wood at right angles to it.

Sharpening Material.

Excepting files, which are dealt with in the saws, this consists of stone. This stone is divided into three sorts—the grindstone, the oilstone, and the axe-stone. I ignore the emery and carborundum, as they should never be used on edge tools, the dry grinding heating and spoiling the steel.

We must remember that the whole question of the power of any stone to sharpen a steel tool is all a question of "grit." What is meant by this ?

That all stone, of whatever variety, is simply a quantity of tiny grains or grits of silica (sand or powdered glass) bound together into a solid mass by some cementing material, usually very, very fine clay. Now, each sort of stone—granite, basalt, sandstone, &c.—contains these little grits or grains of silica in different shapes, and bound together with different cementing materials. As silica is almost the hardest substance known, it follows that when these little grits are

shaped with sharp edges, they will readily cut steel or iron, as both these substances are much softer. (If you doubt this, chop an axe straight down on to a dray-tire, then on to a lump of stone, and see which gaps the edge most.) But as these little grains or grits of silica wear the steel away, they wear themselves away, too, leaving the next row of sharp grits beneath to cut the steel away afresh. Now, basalt or granite is no earthly use for cutting steel or iron, as their little grits are the wrong shape, and are too compactly held by the cementing paste to wear away and let the next lot cut after them. The same may be said of all stone but sandstone and, in a much lesser degree, slate (or shale-stone).

So we can see that it is only the sandstone that is capable of cutting the steel or iron away with its little grits so that we can grind the tool up sharp. But in these stones, even, there is great difference in the sharpness of the little grits, and the way the paste which holds them lets them rub off. The country in this district, for instance, is one mass of sandstone towards Bulli, and I know, from having raked pretty well every yard of it for timber and cattle, that the grits in no two gulleys or ridges are alike. Some would make splendid grindstones, and other grits utterly useless—too hard or soft. Another point that must be carefully remembered is that the cementing material can only hold the little grits properly as long as it has moisture. With some cementing material, when this moisture dries out of it, the material will then set as hard as the little grits themselves, thus when the face grits are rubbed smooth, they cannot rub off to make way for the next sharp layer, and the stone cannot cut. In other cementing material, when the moisture dries out of it, the material then loses its hold on the little grits, and fluffs away into dust, leaving the grits to rub off so easily that they cannot cut the steel. In a grindstone we call the first too hard a stone, and the latter one too soft. Thus it can be understood that the ideal grindstone must consist of stone formed of sharp grits and a good cementing material which will only let the grits rub off when their cutting edge is worn smooth. How are we to get this ideal grindstone, which is one of the most important time-savers on any farm or selection?

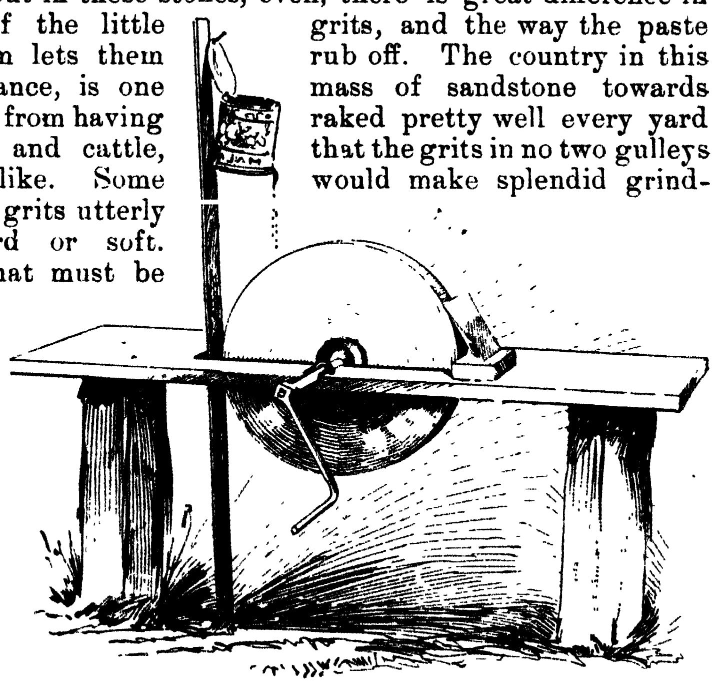


Fig. 60.

There is only one way that I know of, as no two stones are alike in grit now, (the old imported stones were, but, as usual, the howl for cheapness has knocked them out of the market), make it your business to put in a couple of days trying all the second-hand tool-dealers in Sydney, or any big town handy to you, for a good second-hand stone. Get a good judge to go with you, if possible, if not good yourself. When offered the stone, try it first with the thumb-nail, and then with the blade of a good steel knife on the face. By the way it wears the nail-point and blade away, without wearing itself, you can tell its grit and quality. Then look for cracks on the side of it (cemented up), and, if satisfied, give the dealer half what he asks, and you will be suited. The usual price for a good stone second-hand is 3d. an inch (diameter). The fittings are worth very little, as they are generally cast-iron. If wrought add 1s. on to the value of the stone. If not true (round), it takes a little off the value — according to the amount out. The larger the stone the better, up to 4 feet, as it is easier turned and kept true. I find it best, myself, to keep two stones (with a chain and padlock on each for callers' benefit) —a large one, 2 to 4 feet diameter, for coarse-grinding thick tools; and a small fine one (15 to 18 inches) for grinding the finishing edge on big tools, and for small fine ones and knives, which require close grinding. (In the good old days, one could acquire a good stone by the simple process of finding out someone who had a good one, and either bagging it when he was away, or by giving him the choice of giving it to you or fighting you for it. Now, however, since the invention of those new-fangled pests, gaols and mounted police, this is impracticable.)

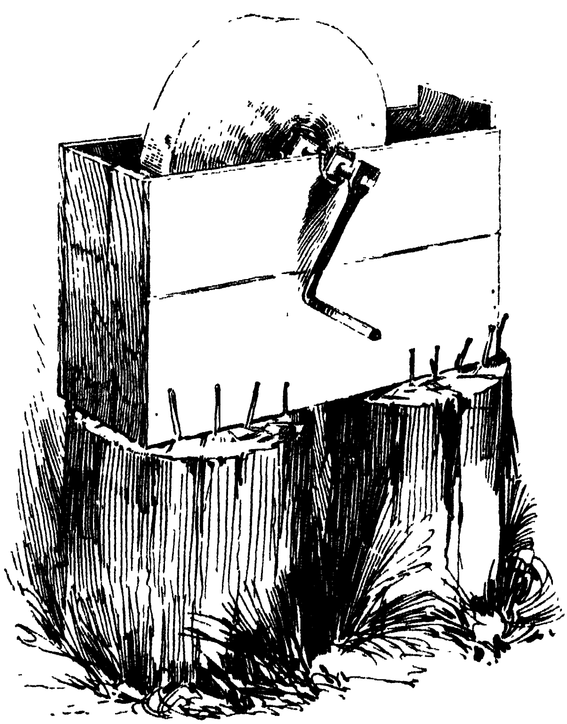


Fig. 61.

The natural question is, why not buy one from the storekeeper handiest, and save all this trouble? Answered, that out of every twenty you buy new, you will perhaps get one good one and perhaps not. If you could strike the good one first try, it would be all right, but somehow the twentieth (if any) is always "it." Also, until a stone has been exposed to the weather a while, and worked a little, it is impossible to tell what it will turn out. That is where the advantage

of the tried stone (second-hand) comes in. As a general rule, the best stones are rusty on the sides (from the oxide of iron in them) and white on the face, of a large sharp grit, and peppered through with little black specks (iron again, pyrites). These are called pepper-and-salt stones, and, on average, are far the best. Some of the brown stones are also very fair, but not on the average, the clay which gives them their brown colour being too soft a cementing material, and letting them grind away too fast. (This is the great fault of all colonial stones; but if people would pay a decent price, say 6d. an inch, there is any quantity of first-class stone available close to Sydney, waiting to be worked up.) The wearing-out quickly is a very great fault in a stone, however fast cutting, as carriage on a stone is high, ditto the chance of being broken in transit.

The best way to get a stone (in theory) is to find out someone who has a first-class stone and buy it from him. This is simply a splendid plan but for two reasons. The first is that the owner of a first-class stone always knows it, and knows too much to part with it; the second, that if he does part, his price will be about six times what the stone is worth. The English stones are the best, but are dear from risk of breaking in transit. The best stone I ever ground on was a broken imported headstone (pepper and salt) picked up in Cobbity churchyard, and masoned into shape.

Care of a Grindstone.—It is no use getting a good grindstone unless you treat it properly, as it can be spoilt by ill-usage just the same as any other tool. In the first place, you must first see that it is "true" (round) before starting to use it; you can tell this by laying a bar just clear across the frame and turning slowly; if uneven, it will bump the bar at the full part. If not true, it must be made so, if only a little out, by fixing a heavy piece of iron, or a bar, on the stand, so that the full ends will just grind on it; as they grind down to the true circle, keep shifting the iron up against them again till true. When right, the iron will be grinding all the time the stone is turning round. If very oblong, get a mason to cut it true if not used to working stone yourself; if you are any good with the tools, mark the true circle from the centre with two nails in a piece of batten or a nail and a pencil, on each side and chip it out yourself. The stone true, see that the spindle runs exactly through the centre. This fixed, set it into its stand, which may be carpenter-made as below, or as I prefer to use it, simply a broad slab squared and set firm and level on two stout blocks in a corner of the workshop. The centre of the slab is, of course, mortised out to let the stone drop in; each side supports its little wheel on which the spindle runs. This spindle is generally cast iron, and is good enough for ordinary use. The handle, however, should be wrought iron, as a cast one is too fond of breaking off short when you are in a hurry. Always have a flat block of wood on top of the slab, at either end of the stone, just clearing it; this acts as a rest for the tool you are grinding, and makes it less liable to jump or chatter on the stone. This chattering is what makes the stone wear unevenly. Fix an upright as shown, with a screw in it on which to hang your tin of water. Anything tin

does for a can, so long as it is watertight; punch a little hole in the side facing the stone, near the bottom, and plug it loosely with a bit of rag or a dry stick; you will then, on filling the tin, have a constant trickle of water on the stone-face whilst grinding. This is much better than the turner knocking off every now and then to wet the stone, and better for the steel, too. Never, under any circumstance, grind tools dry; it burns the carbon in the steel and ruins it. When turning, if you find the tool jumping off once for every time round, stop and turn very slowly till you find the little spot of iron or silica which is causing the jumping; chip it out clean with a nail and resume grinding. Never leave the grindstone exposed to the weather, as heat and cold spoil the cementing material and the stone is then ruined. The topside gets burnt with the sun, or overwetted by rain and dew, and that topside then becomes softer than the bottom, causes the stone to wear out unevenly, and thus become oblong. If impossible for any reason to have the stone inside, always keep a couple of wheat or corn bags thrown over it, to modify the effects of the weather. If you find a stone is too hard, or becomes so after being used a little, soak it in the nearest waterhole for a few hours or days as it requires, and then keep it in a cool place afterwards. If a stone is too soft, put it in the sun for a few hours; this will sometimes bring them right, but, as a rule, soft stones are very hard to fix up satisfactorily. A grindstone for this reason should always stand in a shed, and for another that wet days can be used up profitably grinding tools, thus saving time.

Grinding.—The whole art of grinding any tool consists of grinding it to the bevel which is necessary to its proper working. Every tool must be ground to its own shape; the art of getting this true bevel is, to hold the edge of the tool just as far from the stone as you wish to grind the shoulder down. When the edge is just running on the stone, you know your bevel is ground-up true. Thus you grind from the shoulder up to the edge, not as so many do, from the edge back to the shoulder; the latter way will always give you a bumpy, uneven bevel. Of course, the stone should always turn towards the tool. Grind always on the sides of the stone; when the centre gets too high you can grind there and level it down again; but always keep your centre a little higher than the sides.

Oilstone.—When any tool is ground up sharp by the grindstone, no matter how smooth it looks or feels, if we put it under a microscope we would see that the edge was left rough like a saw by the sharp edges of the stone-grits. To alter this rough edge into a firm compact one, to last and work well, we must rub the edge on another and much finer gritted stone, which is of shale or slate-stone. These finer stones are generally called oilstones, because their grit, to get the best results, requires to be moistened with neatsfoot oil instead of water.

For practical purposes, these stones, as on the Sydney market, may be divided into three sorts—the Turkey, the Washita, and the Mudgee stone. The Turkey is a dear stone; runs from dark grey to white, and when good is far before the others. I never buy them myself, as

for one good free-biting Turkey, you can buy thirty as hard as steel, and thus useless; buying Turkeys is too risky, you may get a good one straight off or you may never; it is all a chance, with, as the immortal Bitzer remarked, "The chances all against the buyer."

The Washita stone is a white one, and when stamped with the guarantee, is a nice fair-biting stone of medium grit, a favourite with carpenters. A fair price for one is from 2s. 6d. to 3s. according to weight. They wear out a lot faster than a good Turkey.

The Mudgee is a dark, slatey stone, of a fine free-biting grit, and an even and reliable class of stone. One good thing about it is that it cuts almost as well with water as with oil; another is that its price is a third of the others. Some last longer than others, the stone being a better quality, having been got out deeper down in the quarry. They wear about as long as a Washita, as a rule. If they were put on the market as a choice-cutting stone from Timbuctoo or Hongkong, I believe they would supplant all the others; but being a colonial stone is, of course, against them. To judge a stone's grit, try it with the thumbnail.

Care of an Oilstone.—The first thing to do is to make a case for it as shown. Cedar is the only wood for this. For holding it firm on the bench for rubbing-up tools, drive in two small nails at the corners of one end, and file them off sharp, leaving about $\frac{1}{8}$ inch out. These two points will keep the case firm, as they dig into the bench. Always keep the cover on when not in use, and in rubbing-up tools only make the one stroke from end to end. Keep plenty of oil on it and dust off it. The middle of the stone should be a shade hollow to hold the oil on nicely, but not too much or it will spoil the bevel. To true it down again, take it over to the grindstone, and hold it against the rough side till it has been ground down to suit you. Another good way is to get a sheet of emery paper, tack it down flat and smooth on the bench, and then rub the stone on it, face downwards, till ground down to suit. If the stone is not cutting fast enough, dust a little emery powder or knife polish on it, with oil; this will make it bite. Rub all edges at right angles to the length of the stone, or it makes both edge and stone uneven.

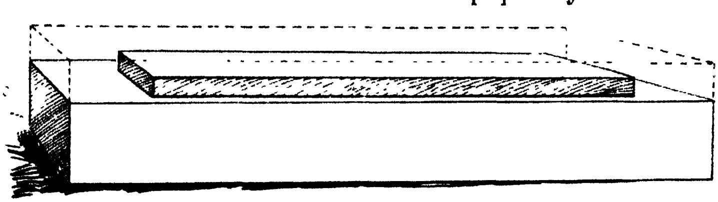


Fig. 62.

Axe-stone.—This is a small pepper and salt stone of sandstone or soft shale, used for rubbing-up axes. They cost about 3d. each, work with water, or vulgarly "spit," and are kept in a pouch on the belt.

(*To be continued.*)

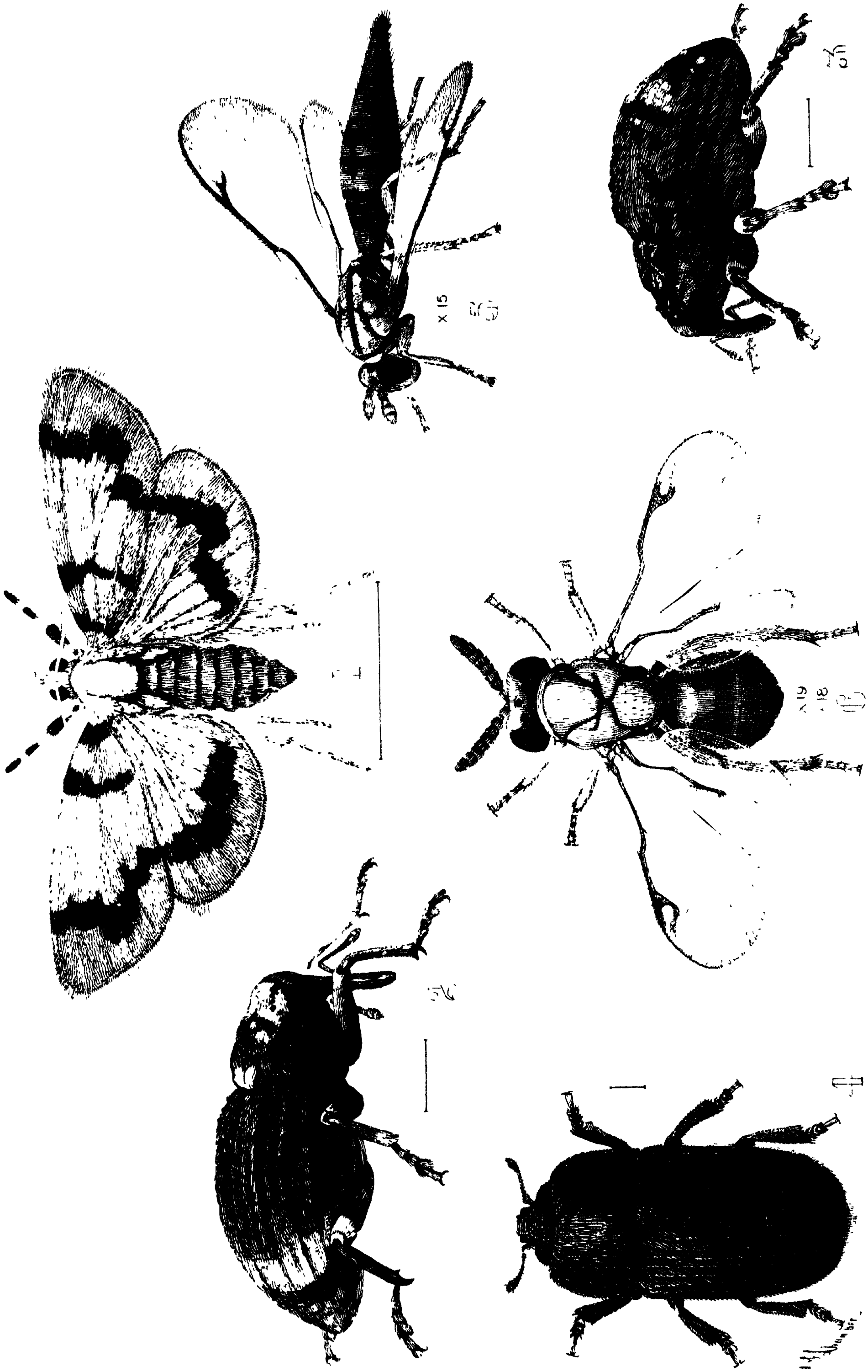
B

The Insects of the Kurrajong.

(*Brachychiton populneum.*)

WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

THE western portion of New South Wales contains thousands of acres of plain and open forest land admirably adapted for the feeding of flocks and herds, which were occupied by the squatters many years ago, and under normal conditions are the greatest asset of the state. In the early sixties they were richly grassed and clothed with saltbush and other succulent herbs and shrubs. As in other parts of the world, closer settlement has altered many of the natural conditions that then prevailed; in the first instance, stocking the land with sheep greatly improved the pasturage; swamps and lagoons that only contained a limited supply of water in the winter and dried up in a few months on account of the porous nature of the soil, when puddled and hardened by the action of the sheep feeding around and over them, held water for months longer and finally became permanent. This can be seen in many of the deeper swamps on the Murray frontages, where belts of dead gum trees extend into the centre of the swamps that had been able to get established when the water dried back every season, but could not exist when always submerged. In the same way the constant traffic of the sheep hardened the surface soil, before boggy and full of open cracks, and thickened the sward of grass; and while the sheep were only sufficient to keep the grass down, the shrubs and herbage were not excessively nibbled. The good years that came in the seventies were responsible for the after-effects of overstocking more than the bad years that followed them. It is all very well to blame the squatter for overstocking, but when a cycle of good years with abundant grass and water followed, a man would have been foolish to let the grass dry up and blow away in the summer when it could be turned into wool and mutton. Then the bad years followed, and land that had carried an immense flock would hardly feed the original stocking; first the saltbush went down before the hungry army; constantly nibbled, each bush became a bundle of dead sticks, soon to fall down and leave a large red bare patch in the grassland; this took some time, but eventually there was no saltbush to fall back on, the sheep had to eat, and they attacked the forest scrub bushes; the soft-foliaged ones, of course, suffered first, and after that came scrub cutting, for the sheep had eaten up everything as high as they could reach. Many stations kept scrub-cutters for more than eight years consecutively, felling and lopping trees for the starving stock. At first the lopped shrubs sent out a fresh luxuriant growth of young foliage, but every fresh lopping impoverished the trees, and the ground was dryer deeper down every year until the tree gave up the



THE INSECTS OF THE KURRAJONG.

1 *Notarcha clytalis.*
2 *Axonicus insignis.*
3 *Tepperia sterculiæ.*
4 *P[illegible]adius pilistriatus.*
5 *Coelocyba viridilineata* n. sp.
6 Flower gall chalcid.

fight and died. With the death of the scrub and grass roots the sheep cut up the surface soil, and the wind blew it along until fierce dust storms, previously rare, became a regular thing, and fences, sheep-yards and dams were covered with the air-borne sand, and the whole face of the country was altered. Rabbits and the introduction of many weed pests have since played their part, but had little or nothing to do with it in the earlier stages of these changes out west.

Now, among the many problems of the west in the future, will be the re-establishment of former conditions, by the protection of salt-bush where it will grow, and the conservation of scrub seedlings, for it is not necessary in many cases to plant scrub trees, they will soon plant themselves; this can be demonstrated by the way the weeping myalls (*acacia pendula*) and other shrubs spring up within the railway fences and station horse-paddocks, when there is not a single one outside. Among the trees that stand out among the drought-resisting trees, that will stand lopping again and again and still send out fresh foliage are the various species of the Kurrajong (*Brachychiton*), of which we can take *Brachychiton populneum* as a typical and widely distributed species, and it is the insects that dwell upon this tree that I am describing.

The Kurrajong (*Brachychiton populneum*, R. Brown).—The graceful pyriform shape that the young trees take, and the glossy green of the foliage, make these trees favourites among the gardeners as ornamental shade trees, though the soft spiny nature of the timber renders it valueless for timber or even firing; but the natives used to make very good twine out of the inner fibrous bark. No tree grows more easily from seed, and young trees are easily transplanted. Mr. Raymond, of Forbes, told me that, when mayor of that town some years ago, he obtained from the scrubs around, trees 10 or 12 feet in height and cut the tops off, leaving them bare poles 7 feet long, but before the year was out they had shot out a crown of foliage and were good trees in a few years, thus gaining some 7 or 8 years, as under ordinary conditions, it takes 10 years for a seedling to grow into a fair-sized tree.

The Mimic Bark Weevil (Axionicus insignis, *Pascoe*).

[Journal of the Linn. Soc., X, 1869, p. 455, t. 18, fig. 8.]

This fine weevil was described and figured by Pascoe thirty-five years ago, the localities given being Gayandah, Queensland, and Wagga, New South Wales. I have found this beetle at all seasons of the year upon the trunk of the kurrajong in all parts of this state, and its range is probably as wide as that of the tree. With its head turned down in front and the legs folded together under the body, it remains in the daytime half hidden in the cracks in the bark, the brown and grey back resembling the mottled slightly roughened surface of the trunk, so that in spite of its size it takes a trained eye to detect it even when numerous. It is one of the finest examples of protective colouration that I know of among our coleoptera.

The beetle, variable in size, measures up to half an inch in length, the general ground colour black, but so thickly clothed with white

and light brown scales that the surface is quite obliterated. The white scales scattered all over the body form two distinct irregular white blotches, one at the basal part of the thorax, and the second on the apical half of the wing covers. *The thorax narrow in front, swelling* out behind, very rugose, with a slight parallel ridge; the wing covers deeply impressed with parallel striæ, coming into rugose points in the centre, but on the sides the punctures follow the striæ, but the whole of the rugosities are much smoothed down and hidden with the clothing of scales. I have never been able to find the grubs of this common weevil, but have often noticed dead branches of the kurrajong that are riddled with holes that may have been formed by the larvæ of this insect.

The Seed Weevil (Tepperia sterculiae, *Lea* .

[Proc. Linn. Soc., N.S.W., p. 660, 1903]

This is another weevil which has a range probably as wide as that of its food plant, and is so destructive to the seeds of the kurrajong that it must have a great deal to do in limiting the spread and number of young plants. I have bred numbers from the large fleshy galls or abnormal growths common on the twigs of the tree, and sometimes bigger than one's fist, but they chiefly develop in the seed-pods, the female boring into the side of the pod and depositing her eggs, often four or five larvæ being found in each pod; they are of the usual short wrinkled form, about 2½ lines in length, dull white, with reddish-brown head, and when full grown pupate in the empty shell of the seed, the pupæ developing into beetles early in June, but not emerging until the spring.

The beetle measures about one-third of an inch in length, and its ground colour is black, but so thickly clothed like the bark weevil with similar rounded grey and brown scales that the dorsal surface is of a general light brown colour with a well-defined grey patch in the centre of the elytron, while the undersurface, except the legs, are more grey than brown. The general form of the beetle is short and broad, the head turned down in front, the thorax narrow and rounded in front and broad behind, the body broader behind than the thorax, rounded and turned down at the tip. The head, thorax, and undersurface finely punctured, the scales on the front of the thorax forming wavy ridges, and on the wing covers, which are deeply striated, regular little tufts that are densest on the back. In the summer this beetle is also to be collected on the tree trunk, with which its tints harmonise almost as much as in the former species; but it has a habit of crawling into every deep crevice in the bark, so that you have to dig it out of its hiding-place.

The Grey-banded Leaf Weevil (Ethemaia sellata, *Pascoe*).

[Journal of Entomology, Vol. II, p. 418, t. 17. f. 25, 1865.]

An account of the curious habits of this pretty little weevil was given by me in the pages of this journal (August 1900), the larvæ being reported as a garden pest at Stockinbingle, where they lived in

the ground, coming out at night to feed on the plants. My young friend, Master Keith McKeown, now finds this beetle under the stones about the roots of the kurrajong at Wagga, and also sheltering during the winter in the seed-pods on the trees. It is evidently a common beetle in a great deal of the dry western country. A detailed description of the curious life history of the beetle is given in the *Gazette* referred to above.

The Seed-pod Beetle (Pocadius pilistriatus, *Macleay*).

[Trans. Entom. Soc. N. S. Wales, 1871, 11, p. 162.]

The larva of this little beetle feeds among the seeds, but chiefly upon the soft inner skin of the pod. In June, numbers of the active larvæ were feeding in pods examined, that had been collected some two months before. They are elongate in form, rounded on the upper surface, and slightly thickened toward the apical portion of the abdomen; the head is small, flattened, rounded on the hind margin, which is overlapped by the front of the first thoracic segment, furnished with short three-jointed antennæ tapering to the tip, and short, black, blunt jaws, the thoracic segments corrugated on the sides, with slender legs furnished with a fine curved claw; the abdominal segments rounded, with the apical segment bearing two pair of spines, the first pair standing out on the dorsal surface, and the hind ones in a line with the ventral surface, but curving upward. They measure about ¼ of an inch in length, dull reddish-brown to yellow in colour, with the surface slightly clothed with fine hairs.

The beetle varies considerably in size from 1½ to 2 lines in length, of a general flattened oval form, with the wing covers not quite covering the tip of the abdomen. General colour, reddish-brown; the head withdrawn into the thorax up to the eyes, which are moderately large, and covered with short bristles or hairs; the antennæ consisting of ten joints, the first swollen, the following ones slender, and the last three forming a flattened club, with short stout jaws. The thorax transverse, rounded in the sides, and as broad as the wing covers, the latter covered with close punctate striæ, with the long pale-coloured drooping pubescence that clothes the whole of the upper surface forming regular rows down the striæ. The curious haired eyes are not noticed in Macleay's description; his specimens were obtained at Gayandah, Southern Queensland. I have specimens taken from the pods of the kurrajong at Gunnedah, Wagga, and other western localities in New South Wales.

The Leaf-web Moth (Notarcha clytalis, *Walker*).

The larvæ of this moth are gregarious in their habits, feeding upon the foliage which they roll and mat together with silken strands forming an irregular cylindrical mass of closely rolled twigs, leaves, or silken strands 8 or 9 inches in length, feeding upon the enclosed foliage; among the remains of which they each drew the sides of a leaf together, forming an irregular chamber about ¾ of an inch in length in which they pupated. The pupa measured ½ an

inch in length, was of a uniform dark green tint, with the black spots of the larva still present, and most of them emerged three weeks after they had pupated, in February.

The larva measures slightly over an inch in length, slender in form, general colour dull green, darkest down the back, the head mottled with irregular parallel bars of light brown, the first thoracic segment thickly marked with black spots, each of the following ones with two pair of dark olive-green marks (the first pair largest) with a corresponding one on either side below; from each spot springs out a fine bristle-like hair, and finer ones fringing the tip of the abdomen. The head is small, deeply lobed, mouth parts projecting, legs slender, semi-transparent, abdomen furnished with four pair of prolegs and stout anal claspers.

Nest of larvæ of *Notarcha clytalis*
Half natural size

The moth measures 1 inch across the outspread wings, and is of a uniform bright yellow, with an irregular wavy line of black running round towards the outer edges of the wings, with two short transverse bands of the same colour on the front of the fore wing near the sides of the body; the outer margins of the wings fringed with fine scales.

My specimens were bred from matted foliage sent me by Mr. Stewart from Berowra, where they had covered some cultivated trees in the garden with their webs.

The Coon Bug (Oxycarenus luctuosus, *Mont. and Sign.*).

This handsome little plant bug that was figured and described in this *Gazette* ("Notes on Australian Hemiptera," 1901, p. 1599) is often found in the empty seed-pods of the kurrajong, where it probably goes for shelter, and where they may remain through the winter. It has a wide range over the eastern portion of Australia, the bright red

larvæ being very different-looking creatures from the adult insects with their black and white elytra. This is a species that may be worth watching, for if it once came much into the cultivated paddocks, like the Rutherglen bug, it might do as much damage.

The Cotton Plant Bug (Dysdercus sidæ, *Mont. and Sign.*).

This insect has a very wide range along the eastern coast, where it shelters on the tree trunks, sometimes in great numbers, but in summer on the northern rivers is common on the cotton plants, where it has very similar habits to that of the "Cotton Stainer" in America. It is figured and described in my paper in the *Gazette* previously noticed. At Richmond my attention was called last year to the immense number of these bugs that were swarming over the trunks of two very large kurrajong trees that were growing in a garden in the town.

Another species of this genus is very common in the western districts, and in both the larval and perfect form cover the trunks of the kurrajong and other scrub trees; in the drought times the bleaching skeletons of the stock in the scrub were also often clothed with such numbers that they took on a bright red tint, the larvæ being much brighter in tint before the fully-developed wings hide the dorsal surface of the abdomen. This species is about the same size as *D. sidæ*, but differs in being of a uniform dull red colour, with only the legs and wings and antennæ black, and the apical area of the elytra brownish.

The Twig Psylla (Psylla sterculiæ, *Froggatt*).

[Pro. of the Linn. Soc., N.S.W., 1901, p. 255, pl. XV.]

This insect lays her bright yellow eggs in clusters on the young foliage between the forks of the branchlets; as the young larvæ hatch out they crawl close together, seldom moving very far, and commence like aphids to suck up the sap with their sharp little hollow beaks. Like most of these naked homoptera (that is, those that do not protect themselves with galls or lerp scales), they can always be noticed by the numbers of ants swarming over the infested twigs, attracted by the honeydew that these little creatures discharge from the tip of the abdomen.

The larva has the head and thorax dull yellow marked with light brown, and the abdomen more of a reddish tint; they undergo a number of moults, in which the antennæ increase in length, the wing pads are developed, and the whole of the upper surface is covered with short hairs bearing honeydew. This final form is the pupa, though, as with all the homoptera, these insects undergo only a partial metamorphosis.

The perfect psylla is a tiny little creature only $\frac{1}{12}$ of an inch in length, of a general ochreous tint, shaded with reddish-brown, marked with black and chestnut brown, with short rounded light-brown semi-opaque wings. They, like the larvæ, cluster along the twigs with the wings sticking out, sometimes almost covering the

surface of the twigs like aphids, so that eggs, larvæ—in all stages of development—and the perfect insect will be found upon the same twig.

When I described this species, I considered it rare, as I had only found it on a single kurrajong near Wagga, but since then specimens have been obtained from half a dozen widely-separated localities, and specimens were sent to me from a garden where they were said to have been damaging the young shoots, by their immense numbers; the trees had been sprayed to destroy them.

The Star Psylla (Tyora sterculiæ, *Froggatt*).

[Pro. Linn. Soc. of N.S.W., 1901, p. 289, pl. XV and XVI.]

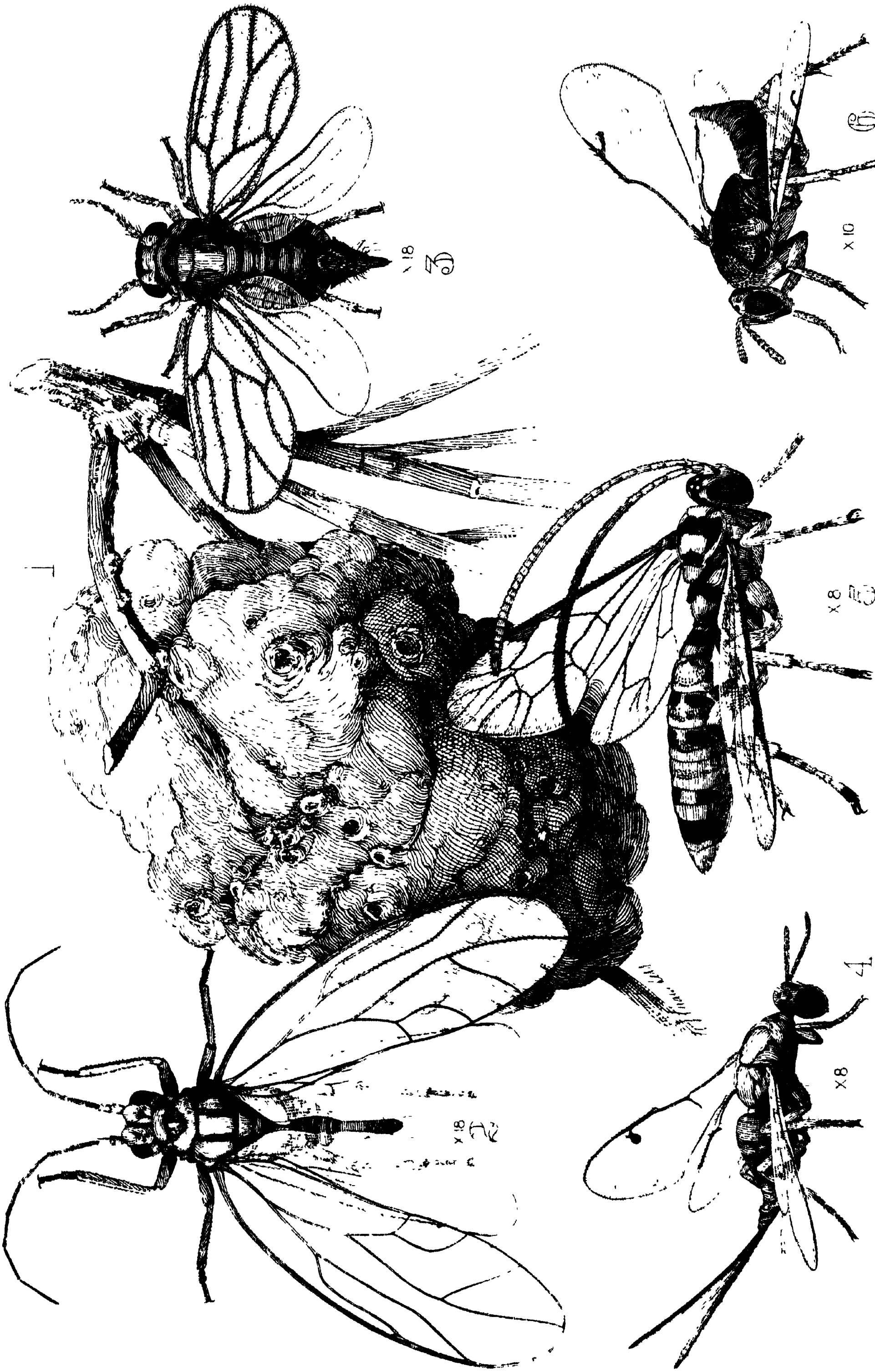
The horn-coloured eggs are laid upon the upper surface of the leaves in patches of from thirty to forty in number; the tiny larvæ, when they first emerge, are semi-transparent, with red markings on the eyes, centre of the thorax and abdomen, with the tip of the latter clothed with the tuft of white filaments. As they reach the pupal form they change to a deep green in the centre with the margins of a lighter green, with a fine red dorsal stripe from the front of the head to the tip of the abdomen. The thorax is broader than the head, with the wing pads short, and the legs stout; the abdomen flattened, swelling out at the base, broadest in the centre, but slightly arcuate on the sides near the tip, from which a number of thick, woolly filaments, from two to five in number, trail out on the sides and extremity, fully ¼ of an inch in length. When a cluster of these larvæ are on the leaf, the white filaments spread out on all sides, giving them a star-like appearance, and each family makes a large white blotch on the infested leaf.

The perfect insect might be easily taken for an ordinary green aphis from its delicate structure, long slender antennæ, and transparent fragile wings. Its general colour is pale green, with red eyes, yellow ocelli, and the segments of the body marked with black. They cluster together on the leaves at first like the larvæ, but afterwards scatter about, and like all the members of the family, jump a considerable distance when touched.

This psylla has a very wide range, from Queensland to the south of this State, and sometimes the foliage of the young trees grown in the gardens and parks are covered with larvæ.

Lump Galls on the Twigs.

There are not so many insects found upon the foliage as one would expect from its soft texture, but late in the season the leaves usually have a very ragged appearance from the number of little punctures all through them. As far as my observations have gone, I do not think that these are caused by the attacks of leaf-eating insects, but are produced after the same fashion as the "shot-hole fungus" of fruit trees. If this is correct, the spores upon the leaves may have some connection with the curious fleshy brown galls that first appear as little nodules upon the twigs, afterwards developing into irregular rounded brownish lumps from the size of a marble to the diameter of



THE INSECTS OF THE KURRAJONG.

1 *The gall*
2 *Tyora sterculiæ*
3 *Psylla sterculiæ*
4 *Megastigmus brachychitoni. n sp*
5. *Ichneumon.*
6 *Thickset chalcid*

a man's fist, for they appear, like the large woody excrescences so common on the black wattle, to commence at first from a common fungus origin, though afterwards infested by a great number of small insects (chiefly hymenoptera) that feed upon the soft woody tissue or are parasitic upon the larvæ of the true plant-devouring species. Following this will be found most of the species bred out of these galls.

The Yellow Ichneumon.

This pretty little ichneumon is about 3 lines in length, of a uniform bright-yellow tint, with dark, yellowish-brown antennæ, and the eyes, back of the head and transverse bands and spots on the upper surface of the thorax and abdomen black; the tibiæ and tarsi of the second and hind pair of legs also marked with the same colour. The wings transparent, iridescent with the stigma and nervures black.

The Long Tailed Chalcid (Megastigmus brachychitoni *n.sp.*)

These curious little wasps are common in the fleshy tissue of the galls, and may probably find their food in it, for though at one time all the members of the genus were supposed to be parasitic upon other larvæ, some species are now known to be vegetarians. The sexes differ slightly in colouration, but the female is much larger than the male with the abdomen of a very different shape and furnished with a long slender ovipositor.

Female.—Length, 4 millimeters. Ovipositor longer than body. General colour, ochreous; dorsal surface tinted with reddish-brown; tips of the tarsi, markings on the abdomen, and ovipositor black. The prothorax marked with transverse pale-yellow lines, the sides and under surface of thoracic segments clothed with fine white hairs and scattered coarser black ones. Wings hyaline iridescent, rounded stigma and nervures black.

Male much smaller, with a cylindrical rounded abdomen, with the same general colour of female with the back of the head, transverse band behind the prothorax, sides and apex of thorax with the whole of the abdomen black. They are active little creatures when bred out in a jar, jumping when touched. There are several members of this genus in our collections all bred from galls.

The Green Striped Chalcid (Coelocyba viridilineata *n.sp.*)

I place this handsome little wasp in the above genus as it agrees with the typical form from which Ashmead defined the group. The first, *Coelocyba nigrocincta*, is bred from the soft spongy galls produced by small Agromyzid flies along the midrib of the leaves of the bloodwood (*Eucalyptus corymbosa*), and the tiny little wasps are so like their hosts in general form and colouration that without a lens it is difficult to separate them when they emerge from the gall. This species is slightly larger than the former, of a rich canary-yellow colour, with the head base of prothorax, a squared and long parallel stripe down the centre of the thorax, and similar transverse markings on the

abdominal segments bright metallic green; the wings transparent with ochreous nervures. A number of these little creatures were bred out of galls received from Parkes in May.

The Thick-set Chalcid.

These chalcid wasps were bred out in numbers from all the galls obtained, and appear to be the commonest species, so that they are probably the hosts of some of the smaller forms. This insect will not fit into any of the genera of the many divisions into which these wasps are now grouped with which I am acquainted, but as my valued correspondent, Mr. Ashmead, of the United States National Museum, has specimens for determination in his hands, I hope to be able to give it a name before long.

Length, 2¼ lines; general colour, ochreous yellow, with the back of the head, behind the ocelli and front of prothorax blotched with black, the centre of the hind portion of thorax and segmental sutures chestnut to light brown, the apical portion of the abdomen marked with dark brown, the wing hyaline, clothed with fine hairs, and nervures brown; the whole of the head and thorax thickly covered with large punctures, with the legs and antennæ clothed with fine hairs. The head is as wide as the prothorax, with the short cylindical antennæ consisting of nine joints, with a short point at the extremity of the 9th like a 10th joint. The pink ocelli large, standing out, eyes large, somewhat hemispherical in form. The pronotum is not as wide as the head, but the mesonotum swells out on the sides; the scutellum large, angled in front, broad, and narrowly rounded to the apex. The legs stout, the thighs thickened in the hind pair, with the apex of the inner edge of the tibiæ armed with two stout spines. The abdomen of female slightly constricted at the base, swelling out and round beyond, flattened on the sides, and tapering to a point turning upward, with the ovipositor showing in a sheath beneath. Male with the abdomen flask-shaped, contracted at the base, somewhat flattened on the summit, broaded and rounded to the apex.

Flower Galls.

Early in December last year, Mr. Musson sent down a number of flowers taken from a kurrajong growing near the College at Richmond, inside of which he had found small circular blister galls, tenanted by a small wasp larva, which had evidently caused their growth. Slightly over a line in length, they are of a uniform ochreous yellow colour, with darker markings on the back of the head and divisions of the thorax, with the abdomen clouded with brown. In general form they appeared to be closely allied to the thick-set gall chalcid, and may belong to the same genus.

Forestry in Germany.

THE following information is extracted from The Diplomatic and Consular Report, No. 596, Miscellaneous Series, viz. :—" Report on Instruction in Forestry, and the present condition of Forest Economy in Germany" ; presented to both Houses of the British Parliament, by Command of His Majesty, September, 1903.

It forms instructive reading, and should be of particular interest to the people of this State, in view of the small attention that has been given to the subject of forestry; and particularly so at the present time, when the popular cry is for the destruction of natural forests, in order that people may be settled on the land.

The first section of the report deals with forestry education, and it is shown that in the whole Empire there are four Academies, three University Institutes, and one Technical University, devoted to this purpose. After detailing the special curriculum at each establishment, the number of students, and conditions of entry, the report deals with the extent and importance of forestry in Germany at the present day. The following is extracted :—

"The entire area of the German Empire amounts to about 135,000,000 acres, of which about 126,000,000 acres are devoted to agriculture and forestry. Of the remaining 9,000,000 acres, which consist of waste and barren land, and of land used for industrial purposes, about 2,000,000 acres might, perhaps, still be reclaimed for agricultural and forestry purposes, by means of bog-cultivation, and drainage.

" Of the entire agricultural area of 126,000,000 acres, about 35,000,000 acres, or more than one quarter, consists of forests or forest land.

" The distribution of the forests and woods with regard to ownership is as follows :—

Owned by—	Percentage.
States	32·4
Town and Villages	15·2
Private persons	48·3
Associations, &c.	2·5
Various	1·6

" As the exposition of the details of forest economy in all the German States is not possible within the scope of the present report, the Kingdom of Würtemberg has been selected as an example.

" Würtemberg possesses 1,500,000 acres of forests and woods, or 30·7 per cent. of its total area, and is therefore one of the best wooded States of the Empire. The additional ground suitable for afforestation purposes amounts to 68,000 acres; if the sum necessary for the afforestation of this further area were available—about £250,000—the

total forest area would thereby be raised from 30 to 35 per cent. Two-thirds of the Würtemberg forests are owned by the State, the communities, and other bodies, and the remaining third is in private hands.

"The value of the total forest produce for the year 1900 amounted to £1,700,000, or about £1 2s. per acre, the cost of production to £500,000, the profit being consequently £1,200,000, or about 16s. per acre; from this the taxation must be deducted, leaving a clear profit of 14s. per acre.

"The figures for the total annual value and profit derived from the forests of the German Empire are, unfortunately, not available, but they can be approximately estimated on the basis of the results obtained for Würtemberg.

The Würtemberg forest area forms about one twenty-second of the total forest area of the Empire. As the Würtemberg annual profit from forestry produce amounts to £1,200,000, the profit for the Empire would amount to £26,400,000 annually. Taking into consideration, however, that the Würtemberg forest revenues are exceptionally high, owing to the very favourable conditions which prevail, and that in other States they are much lower—in Prussia, for example, the largest State, the relative yield per acre is only one-third that of Würtemberg—the amount £26,400,000, estimated above, is certainly too high. The probable annual revenue of the German Empire from forests amounts to from £15,000,000 to £18,000,000.

"Since the year 1860, a gradual steady annual increase has taken place in the values of the produce drawn from State forests in Germany.

"Although the example of the German Empire shows that it is possible to reap a substantial annual benefit from instruction in forestry and the consequent rational cultivation of forests, mere pecuniary gain is by no means the sole factor which ought to justify the solicitude displayed on their behalf by far-seeing governments, as there exist many other reasons, dictated by other motives and considerations, for the cultivation and preservation of forests.

"The forests of a nation are closely bound up with the lives of the people, in legends, poetry and history. In olden times they were protected by laws and statutes under pain or severe punishment, and they are still preserved in some countries with the greatest possible care, not only by the State, but by private landowners, provincial and municipal corporations, and other bodies. An empire of the inland extent of Germany, for example, requires, for social, hygienic and climatological reasons, a larger extent of forest land than countries with a less extent of inland and longer coast lines. The proximity of forests acts upon those who dwell in or near them in a similar manner as the proximity of the sea exercises a healthy influence upon those who dwell on or near the coasts, and it may be asserted that, to some extent, a country without forests resembles a country without a coast.

"The inhabitants of the forests—the foresters, woodcutters, and other forest workmen and dwellers—are, as regards health, strength and a certain native shrewdness and sagacity, as superior to the peasants of

the plain as these again are superior in health, strength, and many sturdy virtues to the majority of the inhabitants of the towns.

"From an æsthetic point of view, forests are absolutely necessary—as necessary in their special province as dunes, moors, heaths, rocks, mountains, and even bleak lands, as they all form the necessary complement to cultivated lands, and impress upon the beholder the infinite play of contrast and variety displayed in all the manifestations of nature.

"Finally, from a climatological and hygienic point of view, the value of forests to a nation cannot be too highly estimated. The presence of large forests supplies the air with moisture, and most probably exercises influence upon the regularity and extent of the rainfall; heavy and protracted rainfall which might cause serious inundations is regulated, to a greater or lesser extent, by forests, which act as natural reservoirs for water storage and gradual supply. Air vitiated with dust and other impurities, chemical, physiological, and mechanical, pass into forests to undergo filtration and chemical transformation, and issues forth again purified and revivified with health-giving constituents. The fate of parts of Italy, which, under rational conditions of forestry and agriculture, might have been the paradise of Europe, is a warning example, amongst many others, of the dangers that attend the practice of reckless deforestation, and the conclusions to be drawn therefrom have not been overlooked in Germany, where unruly rivers are now being rendered amenable to control by afforestation at their sources.

The devastation caused by the recent floods in Silesia, shows the necessity of action of this nature in Germany.

"In Switzerland, where the floods have wrought much damage during the rainy summer of this year, an influential party is advocating the diminution or prevention of floods by afforestation instead of by engineering works for the regulation and correction of the courses of rivers, to which latter the preference has hitherto been given. The Association of Forestry, which met lately at Schwytz, has expressed itself most emphatically in this sense.

"Leaving aside the question of the relative efficiency of the two methods of the prevention of floods by river regulation or afforestation, the former is certainly much more expensive than the latter. Between 1871 and 1901 the Swiss Government has expended about £2,000,000 on the regulation of rivers by engineering works, and only about £125,000 on afforestation work for the same purpose."

The Wool Industry.*

A. HAWKESWORTH.

THE members of the Sydney Chamber of Commerce having decided to hold a series of exhibitions of the various products of this State. Wool, the most valuable of all our raw products, would necessarily take a high and important place in this series.

Through my extensive experience amongst the sheep stations, and through personal contact with wool-growers in this great centre, but more especially in my official capacity in charge of the Sheep and Wool Department, Technical College, it has often occurred to me that there is a lack of knowledge amongst wool-growers, generally regarding the very material, which they are permanently engaged in producing. This want of wool knowledge does not rest alone with those in the country, but with many who have responsible positions in connection with the work of its classification and general preparation for the different requirements of the markets; and our customers should most certainly be considered. In fact it may be said that there is room for all-round improvement in the general knowledge of wool, especially as this industry is growing in importance every year, and a man with progressive notions will no doubt derive the greatest benefit. How many could sit down and write proper answers to such simple questions as—What is wool? Describe a fleece of wool in detail? These are ordinary every-day questions, which every wool classer, apprentice, and student should be able to answer without delay, but how many could do so who have not had special training? My method of training is three parts thorough practical work and one part theory; these two together go to make an important tradesman, such as is now required by the wool-growers, who are finding out that the man who will go to the trouble of improving himself in general wool knowledge is by far the most reliable, and understands his work much better. In fact the study of wool may be claimed as a progressive science, and no doubt a great improvement has been made during the last few years in this direction. When it is acknowledged that the wool industry, from the earliest dates of this continent, and this State in particular, has been the very core of its existence—that is revenue—it is a strong statement to make that probably there is no other profession in which those interested, excepting the buyers, know so little of this product on the theoretical side. What has been accomplished by the sheep-breeders during the last 100 years is almost incredible, and we have only to refer to the first Australian wool grown by the Rev. M. Marsden, now on exhibition, and imagine the very great difficulties under which the early pioneers of the wool industry were placed. They began by taking from the men-of-war

* A lecture delivered at the Royal Exchange Wool Exhibition, January, 1904.

and merchantmen the ration sheep, which gave a fleece of hair and wool weighing about 2 lb. The early pioneers were so convinced by the successful results of their experiments that the climate was suited for sheep, that whenever opportunities of purchasing sheep for further improvement occurred, these sheep were secured. In 1824 a general improvement was noticeable; more importations were received, and these at the time were good sheep, their fleeces being fine, and weighing about 6 lb. During the next thirty years greater advances were made in stud sheep, both in regard to quality and quantity of fleece, which weighed from 8 to 12 lb. In the sixties we find a still greater improvement. Now, take the celebrated ram "Sir Thomas" as a conspicuous example, with a fleece of perfect wool, length and quality combined, weighing about 16 lb. From that time to the present there has been a gradual increase in weight of fleeces. As another example "Jubilee II" may be mentioned, almost perfect in form, with a fleece of high-class wool, turning the scales at 32½ lb. This ram was sold by Messrs. Goldsbrough, Mort & Co. in July last. However, to-night it is not intended to consider the sheep so much as its covering, or wool. This is a very comprehensive subject, every detail forming a separate text for consideration. My remarks will therefore be summarised so as to cover as much ground as possible, and will be divided into three parts, viz.:—(1) Wool; (2) Preparation for market; (3) Uses.

It will in the first place be necessary to give a definition of what wool really is, as its structure and nature differ from all other hairs, of which wool is a kind. It is mostly described as the covering of a sheep, but, strictly speaking, exception can be taken to this answer, as some sheep have in their fleeces hair, gare, and kemp, none of which are wool; also, some sheep in foreign parts produce a coat of hair. Again, such animals as the cashmere, angora goats, alpaca, camel, beaver, rabbit, and vicuna produce a woolly fibre, so that the definition must be taken as of a fibre, independent of the animal which produces the fibre. A hair is a fibre in which the body is composed of very fine elongated fibrils or cells, massed together and covered with a coat of fine scales, the edges of which fit accurately together like the tiles of a pavement; the whole fibre is straight or slightly curved; a wool fibre is a modified hair; it differs from an ordinary hair in not being straight, but rather bent into little waves which are the crimps; the scales, too, which form the covering of the fibre do not fit smoothly together in a wool fibre, but the upper edge of each scale projects out beyond the general surface of the fibre, producing a serration. The waves forming the crimps can easily be seen by the naked eye; in fine merino wool as many as thirty occur in an inch of fibre, while in a Lincoln the waves will average one or two to the inch. The serrations can only be seen with the aid of a microscope, and as many as 3,000 may occur along the length of one inch of fibre; but they may plainly be felt by drawing the staple from tip to base between the thumb and forefinger. The crimps confer elasticity, softness, and felting power on wool, whilst the serrations are a powerful agent in the production of felting power. Owing to

the absence of crimps and serrations, hair does not possess these properties, and herein lies the essential difference between the two.

Hairs and wool fibre are growths developed in little pits in the skin. These pits are called follicles, and the hair or wool fibre grows out from the bottom of the follicle, the part of the fibre which lies in the follicle being called the root. Into the base of the follicle, and also the base of the hair root, projects a capillary loop of blood vessels, the lymph exuding from which nourishes the hair. Into the cavity of each follicle in which a hair or wool fibre lies, open the mouths of one or two glands known as sebaceous glands. These glands secrete a fatty or oily substance which keep the surface of the fibre in good condition, and forms the yolk of the wool.

But through the whole range of the distribution of goat's hair and sheep's wool, nature shows such close gradations that it would be difficult to draw an exact line between hair and wool. The microscope distinguishes very clearly the difference between wool and silk, the fibre of which is an even double filament of homogeneous gummy substance exuded by the silk worm, and between wool and other vegetable fibres, such as cotton, which grows as a tube, dries into a half twisted ribbon without any barbed edges.

Preparing Wool for the Market.

When the harvesting time arrives, all the producers are naturally anxious as to the state of the markets, and the prices likely to be obtained by the sales of their produce. These prices are more or less uncertain, the requirements of the trade, from many causes, ebbing and flowing. All growers of produce, after a year's labour, would act contrary to their best interests if they did not give some consideration and thought to the most approved methods of placing the result of their labour to the best advantage, so as to realise the highest prices, to the last farthing. All produce, whether in the raw or manufactured state, requires more or less grading or classification; even the cattle grazier sends his stock to the markets in some classified form by drafting the fats from the stores, and when the salesmen receive a mixed mob, they will draft or classify into even pens necessary for the various requirements of the trade. It is safe to say that if the cattle salesmen did not think that they realised more for the owner, they would not go to the trouble and heavy work of drafting or classifying.

All produce, crops, even fruit and butter, require more or less attention by keeping the good from the indifferent, and when not carefully treated, low prices result to the financial detriment of the producer.

In the wool sales, one comes across many clips without the least attempt at classification, or even skirting or trimming of the fleeces. To say the least, it is most regretable that this wanton negligence still continues amongst many of our wool-growers, and if they would only throw aside their conservative ideas, and study their cutsomers more, and meet the requirements of those who come from foreign countries to purchase their wool, thereby ensuring speedy and increased returns, they would receive a more substantial revenue, and be better able to improve their flocks and holdings.

I am much opposed to over-classing of either large or small clips of wool, more especially the latter, but there still remains much to be desired even amongst the former. To all, and especially those who do not believe in classing, it is advisable, it is even absolutely necessary, to judiciously skirt every fleece before pressing, and just make a long stapled wool into one sort, and keep the shorter separate, and press them by themselves. By so doing, your wool is arranged for the buyers of a combing wool, also for the buyers requiring a short wool for the cloth trade. Besides, a buyer of fleece sorts does not want skirtings, and will considerably increase his valuation on the skirted lots. In regard to the pieces competition is always keen, owing to the activity of the local scourers; therefore, the grower receives the benefit.

A word of advice to the struggling farmer and selector, and even many larger wool-growers: always press fleeces by themselves, and do not mix in the sweepings, locks, and dags, as so frequently happens. This is a dangerous practice, and sometimes leads to expensive litigation.

There are two recognised general divisions into which wool is divided for the manufacturer; the first and most comprehensive includes various classes or varieties of long-stapled wool suitable for the worsted or combing trade; the second, those wools of shorter staples required for the woollen or clothing trade. In all of our large Australian flocks we find wools especially suitable for both divisions, differing on account of the age of the sheep, and in many instances the length of time the wool has grown between shearings. We have also flocks producing a pure type of clothing wool, and unsuitable for any other purpose. This is short of staple when of the natural twelve months' growth, and is distinguished by its beautifully close, crimpy formation, generally denoting the presence of serrations, consequently better adapted for felting, which is a necessary factor for the manufacture of high-class cloths. Even in the case of an acclimatised breed of sheep, removal to a different locality may cause the length and quality of the wool to vary; this alteration or change is fully illustrated in cross-breeds, which, when placed in a suitable locality and pasture each succeeding season, will show an improvement in the length and quality of their wool. Take, for instance, a merino; its wool may be improved from a 58's to 64's, or from strong to medium in the course of two or three seasons, and the cross-breds are liable to similar improvement; the early crop may have been of a 46's quality, and changed to a 56's, coming near to the strong merino qualities. When it is mentioned that out of the 30,000,000 sheep in New South Wales there are not two fleeces alike in all detail, surely it is not too much to suggest that there is some scope to make two or three classifications each of the long combing and short clothing wools, amongst all clips of 8,000 or 10,000 sheep, and a classification of long and short in clips under that number.

No doubt the accommodation for handling is very inadequate in most station wool sheds, yet a practical up-to-date wool-classer will surmount many difficulties, and it is surprising to see the creditable

manner in which some clips are placed on the market, even under disadvantageous circumstances.

When commencing to classify a clip of wool, a classer should consider, firstly, not to over-class, or make too many sorts; each sort should contain as near as possible fleeces of the same length, quality, soundness, colour and condition; secondly, see that every fleece is skirted previously and rolled neatly, so as not to show the back part; thirdly, take out all tar brands; never tie with string; finally, see that the skirtings are carefully picked, making "1sts" of the largest and best wool after having been trimmed, "2nds" pieces and the skirtings of the 1sts and low bitty, but too large to fall through the bars of the table into the locks; stained pieces should be kept to themselves. All belly pieces should be trimmed and made into two sorts, long and short, the stained portion having been removed. Generally speaking, the 1st combing will contain about three parts of the average length and quality of the fleeces, whilst the 2nd combing contains all fleeces decidedly too strong, usually a longer, a stronger, and really a lower quality than the 1st, and if a super sort is made, let it be the very pick of the fleeces, finer (70's and over), lighter, and altogether distinctly superior to the 1st in every respect.

Frequently great mistakes are made through classers trying to force this super sort when there is not really sufficient distinction. The clothings are those fleeces not sufficiently long for the above combing sorts, the length being the distinction, and are 1st and 2nd clothing.

In most clips it is necessary to make a conditioned sort of those fleeces containing 8 per cent. and more of yolk than the average fleeces.

We have many clips of high-class wool, even in quality and length, which should be classed into two sorts only, the average conditioned 1sts, and the heavy conditioned 2nds.

As regards tender wool, many mistakes are made by placing unsound wool with the sound. This should not be permitted. A separate class should be made of tender fleeces, instead of, as is frequently done, placing a wool of combing length, but tender, into the clothing classes, which are then not only wrongly branded clothing, but mixed with the short, fine, sound, true clothing type. Always make a separate sort of the tender wool and call it (*a*) or (*b*) fleece, and do not give it the name of combing and clothing.

Cross-breds.

The classification of cross-breds is neglected greatly on most places where it is grown, the lowness and varied qualities appear to puzzle the majority of wool-classers, and there is no doubt that to do justice a more extensive knowledge of qualities is required than in the merino.

In the first place, the crossing of the merino with any of the English breeds of sheep, probably excepting two or three of the Downs breeds, result in the progeny giving varied and uncertain results, even in the half-breds, varying from the very strong to the fine; and, when there is indiscriminate crossing, those classers who are capable with the merino are at a loss with the cross-breds.

To class cross-breds the classer must be well acquainted with the spinning qualities, varying from the low Lincoln—as an example, say, 24's—to the superior comebacks to 58's, where they meet the strong merino. Within these ranges will be included all the possible classes of cross-bred fleeces, varying greatly in appearance from a first demi-lustre, second-demi to the ordinary bright. The first demi-lustre or half-lustre will be found to be wool of the lower qualities of cross-bred, such as the half-bred Lincoln, Leicester, up to a 44's quality; usually, a lengthy, comparatively straight, broad-haired type, and a really useful wool. The sort above will be less glossy, finer, not so long up to a 48's; above this sort are three, from 50's to 56's, a really fine, bright, soft kind handling wool, a little straight in fibre or in undulating curves. The highest class invariably—comeback, and those fine, curvy wools showing more of the merino character—become sometimes so fine as to be used in preference to the strong, plain, straight merino wools. Many of the intermediate British sheep used for crossing with our merino, such as Romney Marsh, Border Leicester, Cotswald Cheviot, give a fleece varying in quality from 44's to 54's. Besides, condition should receive consideration. All pure-bred fleeces should be pressed by themselves, being a distinct or different type to the crosses. All these wools, on an average, require skirting lightly; in most cases, simply trimming off the dirty edges.

Tar Brands.

The manner of branding sheep is treated as a matter of no consequence by the great majority of sheep-breeders and wool-growers. This is much to be regretted, and, if our pastoralists had only the slightest idea of the damage done to both machinery and fabrics when there is tar in the fleece, I think they would try to make some improvement, and meet the wishes of the manufacturers. It must be granted that sheep-owners must have some distinguishing mark, so as to be able to recognise their own; and is it not possible that, by exercising more care and using less deleterious agents, this difficulty might be overcome, to the benefit of all? My experience on stations during shearing is that this work is carried on without the least consideration whether the work is neatly done or not. I have seen the whole pot of tar thrown at a restive sheep by the still more restive brander. This I have seen on several occasions and on many different stations.

The advice to our wool-growers is not to use tar or pitch in branding their sheep; this material clings persistently to the wool, and cannot be removed by scouring, so that some of it finds its way into the delicate mechanism of the combing machine, and remains in the noil after combing. This seriously detracts from the value of the wool, also causing losses through claims. Fire-branding on the face, together with a small liquid brand somewhere about the neck or head, might be equally safe for the owner and add to the value of his wool. When the brand is on the body or fleece there is no possible chance of skirting it off, whereas, if placed on the neck or head, it could be easily skirted off.

Use of Twine.

For many years back there have been continued complaints made by the manufacturers against the use of twine to tie fleeces. It is a question, which causes the most damage to the machinery, or manufactured article—tar or twine. To a great extent sheep-branding is a necessity, but the use of twine for tying fleeces is altogether unnecessary. This work of securing fleeces can be equally as well done and without cost, and at the same time more in accordance with the wishes of the best judges—the manufacturers. I would advise all wool growers to further consider the use of twine, both at the wool tables and even in the pressing room. The serious part of the complaint by the buyers is that, when twine is used for fastening fleeces, there is every possibility and probability of some large or small portions finding their way into the scouring tub, or into the cards, endangering their delicate mechanism; thence into the combing machine, and getting entangled in the rows of fine teeth; then into the yarn, and finally into the woven cloth. At this stage it is a very serious matter with the manufacturer, who, having been put to the expense of making the cloth, finds his whole piece of cloth rejected by the merchant, because of the presence sometimes of a small bit of flax or hemp which will not take the same dye as wool. On stations where twine is used for fleeces, it becomes a serious item—first its cost, then commission, carriage by rail and road, and finally the employment of men to cut it into suitable lengths for the fleeces. Does not all this mean a waste of money? Undoubtedly, especially when the fleece can be made equally secure by simply drawing out a small piece of its own wool, give it two or three twists into a tassel form, and with it the whole fleece is tied. This is done at no extra cost, and there is no future danger of damage to machinery, or rejected fabrics.

On all stations wool must be pressed, and it is right here where there is a great amount of carelessness, and probably where the greatest danger arises. Wool pressers should never be allowed to cut down the sides of the pack in the wool room. There is plenty of room outside, where there is no danger of the small bits of twine getting into the wool, the smallest of which would cause the largest piece of cloth to be returned. Another dangerous practice is the cutting off a few inches of the pack, which is usually thrown into the pack along with the wool. These pieces are more or less jagged, and invariably get entangled with the wool, and serious damage may be the result.

Uses of Wool.

With washing or scouring commences the initiatory process of manufacturing wool into fabrics, and is a most important operation, and a few words upon this subject might be of interest, not only to those generally interested in wool, but also to those who are engaged in that particular work.

In the first place, a great deal of good or harm can be done in this important work. The general idea is only to wash the wool a good colour. Certainly, colour is a great consideration, and to obtain that

object the condition of the wool must be studied by the operator and treated accordingly. Different classes of wool vary considerably in the amount and constituents of their yolk, some containing 30 per cent. and others 70 per cent. of yolk and dust which have to be removed. This work should be carried out so as not to injure the manufacturing properties, and in order to preserve these, great care and judgment is necessary. If severe methods are adopted, as too hot water or strong reagents, the wool not only loses unnecessary weight, but also becomes hard and brittle, and the dyeing and finishing adaptability are injured and cannot be replaced.

After scouring the wool is dried; it is then put through a teasing machine, which simply opens out the wool, so that it will pass more easily through the rows of fine delicate teeth of the wool carder. Carding is common to both woollen and worsted processes.

The long wool passes through many hands and many different forms previous to reaching the final stage of dyeing and finishing:—

1st. The wool buyer who sorts it ready for the comber.

2nd. The commission wool comber, who combs the wool, and sends the wool back in the form of tops, noil, and waste.

3rd. The tops maker sells the tops to the worsted spinner, the noil and waste to the woollen manufacturer.

4th. The spun yarns are sold to the manufacturer, who weaves it into various fabrics.

5th. The cloth is sold to the merchant.

6th. From the merchant the cloth goes to the dyer and finisher, according to the requirements of his customers, the retail woollen drapers.

The manner in which wool is manipulated for the combing or worsted process is altogether different from that of the woollen or clothing process. The fibres are all combed to their fullest extent, straight, level, and placed parallel to each other, for which the longer stapled wool is best suited. The original idea of wool combing was taken from a woman combing her hair, and the same method was applied to wool, and from this simple primitive method developed the ideas of the great machine combing industry.

The initial stage is opening or loosening out the staples so that they will more easily pass through the next machine, called the preparer, which is preliminary to the carding, and it is doubtful if an expert could tell whether the sliver was prepared or carded. When carded, the sliver has a cloudy appearance, and contains all short, faulty, unsound fibres, which are combed out whilst passing through the rows of fine steel teeth in the combing machine. This process forms all the sound perfect fibres into what is called tops, ready for the worsted manufacturer, and all the delicate, mushy fibres into noil, which are mostly used for making flannel, a branch of woollen manufacture. The combed top is now ready for the different stages of drawing, each stage reducing the bulk of the sliver by drawing out, until the spinning frames are reached. At this stage the fibres are stretched to their utmost length, twisted hard into smooth yarns. These yarns are afterwards arranged in the weaving

loom and woven into various classes of smooth-faced fabrics mostly for ladies' dresses. Merino long wool is especially used for this purpose.

The woollen manufacturing process is altogether different from that of the worsted. In it the short, fine, sound, highly crimped wools are used when making the best qualities of cloth, and the lower short classes of wool are made into cloths of lower standards. The tender wools have their uses; being weak, wanting in manufacturing properties, and generally devoid of felting power, they are best suited for making light fluffy loose hosiery goods, in which felting properties would be detrimental. The short or clothing wool is first opened out, and is then passed through three different stages of carding, the scribbler, intermediate and finisher, and stages confined exclusively to woollen manufacture. These three machines are complicated, each drawing a series of large and small cylinders named "Licker in," "Worker," "Stripper," and "Doffer," all of which are covered with minute steel teeth. On the carding engine proper, there are as many as 24,000,000 of these teeth through which the wool passes, forming the disentangled wool into a thin, broad gauze-like film which is now called carded sliver.

This gauze-like sliver is now passed on to the condenser, the latter part of which is divided into a series of equal strips; over these the sliver passes, and is formed or condensed into round carding sufficiently compact to stand the strain of winding on to large spools or bobbins. This may be called the initiatory stage of spinning into yarns—the last process of drawing and twisting. These yarns are afterwards woven into cloth mostly for men's wear.

Barleys—Bathurst Experimental Farm, 1904.

The following are the yields of the barley crops grown at this farm for the year 1904:—

Variety.	Yield per acre.	Weight per bushel.	Date sown.	Date Harvested.	Rainfall during growth.	Remarks.
	bush.	lb.			inches.	
Standwell... ..	51½	54	April 18	Nov. 18	10·74	Malting varieties.
Invincible ...	44½	53½	,, 18	,, 22	10·74	Malting varieties.
Carter's Malting...	38½	53	,, 18	,, 19	10·74	Malting varieties.
Kinver Chevalier..	32½	52½	,, 18	,, 22	10·74	Malting varieties.
Cape Barley ..	38½	45	,, 5	,, 22	11·46	Cut for green fodder in July.

The rainfall for the year totalled 18·26 inches, being 6 inches below the average. The quantity of seed sown ranged from 30 to 40 lb. per acre. Owing to the light rainfall of November, the season favoured the early varieties. Standwell is more suitable for such conditions than the other malting varieties. The preceding crop was rape, and the land was well cultivated, allowing of satisfactory yields under rather adverse conditions. No manure was used.—R. W. Peacock.

Insectivorous Birds.

A New Genus of the Order Passeres.

ALFRED J. NORTH, C.M.Z.S.,
Ornithologist, Australian Museum, Sydney.

ORDER PASSERES.

Family Timeliidæ.

Oreoscopus, gen. n.

Generic Characters.—Bill long, straight, wide at base, equal in length from gape to tip, to length of head. Wing concave, rounded, and exceeding by one-fourth the length of the tail; the wing-formula similar to that of *Sericornis*. Tail slightly wedge-shaped at the end, feathers broad, the lateral ones with broad outer webs. Tarsus moderate, equal in length to the middle toe with claw, the lower three scutes very distinct.

Type.—*Sericornis gutturalis*, De Vis, Proc. Roy. Soc., Queensland, vol. vi., p. 244 (1889).

Range.—North-eastern Queensland.

The figures on one of the Plates, which are reproduced from a photograph of the skins of the birds, represents *Oreoscopus gutturalis*, and *Sericornis frontalis*, the latter the type of the genus *Sericornis*. The figures are of the natural size.

In the proceedings of the Royal Society of Queensland, Mr. C. W. De Vis, M.A., from a single example, described a bird that inhabits the scrubs of the Herberton tablelands, also the higher peaks of the Bellender Ker Range in North-eastern Queensland, under the name of *Sericornis gutturalis*. Several specimens were also received about the same time from Messrs. E. J. Cairn and Robt. Grant, who were collecting on behalf of the Trustees of the Australian Museum in the same part of that State. The abnormally long bill and comparatively long wing of this species, induced me to impress on collectors at all times the desirability of trying to discover the nest and eggs. After a lapse of thirteen years, the Trustees of the Australian Museum have received two nests and sets of eggs, taken by Mr. H. Elgner, also for identification a skin of one of the parents captured on the nest. As will be seen from the following descriptions, the eggs are as widely different as is the bird from the typical form of the genus *Sericornis*.

The nest is a dome-shaped structure, with a comparatively large oval entrance in the side, and is composed almost entirely of fresh green mosses, with a slight admixture of fine black fern stems and a few skeletons of leaves, there being no other lining inside other than the green moss, except here and there a small tuft of opossum fur.

Of the two nests forwarded, one has the appearance at the back of having been attached or partially built in a hole, the other, which is figured, having the base only resting on the ground. They are both of the same average dimensions, measuring at the front 7 inches in height, and from front to back 5 inches; entrance, 2 inches in width by 1½ inch in height.

Sericornis frontalis. *Oreoscopus gutturalis.*
(The figures are of the natural size.)

The eggs are two in number for a sitting, oval in form, the shell being close-grained and perfectly devoid of lustre. A set taken at Black Mount on the the 10th August, 1904, are immaculate white, and measure—length (*a*) 0·89 x 0·66 inches; (*b*) 0·89 x 0·67 inches. Two eggs of a set taken in a gully on the Macalister Range, on the 21st October, 1904, are pure white, with numerous small and almost invisible dots and spots, which, when examined through a lens, are found to vary in colour from a pale to a rich purplish-red. The eggs of this species resemble those of the Rock Warbler (*Origma rubricata,*

Latham), which, in some instances, are pure white, in others finely dotted on the larger end with purplish-red; also, those with markings, a variety of the eggs of the Fulvous-fronted Honey-eater (*Glyciphila fulvifrons*, Lewin). They are totally unlike the typical and normal eggs of any species of *Sericornis*.

Nest of *Oreoscopus gutturalis.*
(About half natural size.)

From notes sent by Mr. Elgner, I have extracted the following:—"The first nest of *Sericornis gutturalis* I found was in November, 1903. In the following month I found another, built in the side of a gully, near the Upper Russell River, with an egg in it. The following day I flushed the bird from the nest, but only caught a glimpse of it as it rapidly passed over the fallen leaves lying on the ground; the nest now contained two eggs. The nest was visited on four occasions during the two succeeding days, and then it began to rain, continuing

without a break for two more days. On visiting it the following morning, as I anticipated, part of the nest had been washed away with the water, and the eggs were lying broken on the clay below. On the 10th August, 1904, when on Black Mountain, I found another nest containing two fresh eggs, but did not see any bird about it. This nest was built in a similar position to the previous ones, being partially built in a hole in an almost perpendicular bank on the side of a gully overgrown with small ferns and mosses, rendering the. nest nearly invisible, although the gully was close to a track. Returning to my camp, I provided myself with a butterfly net, and, as soon as it was quite dark, without boots, and carefully shading a candle light, again visited the nest. Quickly placing my net over it, I caught the bird just as it was flying out, and took the nest and eggs. In the early part of October I found two more nests with two eggs in each, which had been abandoned by the birds, as the yolks were dried up in them and adhering to the shell. The eggs in these nests were not pure white, as those previously found, but had a few small spots on the thicker end, so I did not know whether they belonged to the same bird or not. A few days later I was on the Macalister Range, when, coming down a gully, I saw a little bird with some moss in its bill run on to a piece of dried wood. Looking with my field glasses, I saw it was *Sericornis gutturalis*. I went lower down the gully and up on the bank and sat down among some bushes. The bird flew over to the opposite side of the creek, then back again, hopping within 4 feet of me. I kept very quiet. Then it went behind me, and flew over again to the other side of the creek. There was a very steep place where it disappeared. I watched it return four times into the gully and gather moss off the rocks and go back to the same place, and where later on I discovered the nest. Marking the spot, I returned a week later, on the 21st October, 1904, and found the bird setting on two fresh eggs, which, together with the nest, I took. The eggs in this nest were also speckled on the thicker end."

There are four adult skins of *Oreoscopus gutturalis*, in the Australian Museum Reference Collection—two males and two females—also the skin of a young bird. The young resemble the adult, but the supercillary stripe is dull ochraceous-brown, and the throat is uniform in colour with the breast, the fore-neck being of a more dusky shade of brown; wing, 2·4 inches; tail, 1·5. Vernacularly, this species of insectivorous bird may be distinguished under the name of the Fern Wren.

Bunt Preventives and their Effects upon the Germination of the Grain.

R. W. PEACOCK,
Experimental Farm, Bathurst.

FROM many observations in the field under dry conditions, I concluded that the ordinary bluestone method of preventing bunt seriously interfered with the germination of the wheat grain, especially when the land contained only a limited supply of moisture. In order to throw more light upon this subject several experiments were carried out which proved beyond question that bluestone may kill considerably over 50 per cent. of the grain sown.

It was also proved that the germination of the grain was considerably delayed when the bluestone method was used.

I would point out that I am of the opinion that solutions of bluestone may be used much stronger without serious injury when the ground is well nigh saturated with moisture than when it contains only a limited amount ; it would therefore be possible to use a solution of a given strength without injury to the grain in a moist season, whereas the same strength would kill over half of the grains if sown in a comparatively dry seed bed.

The method adopted in the experiments was to infect all the grains with bunt, and to immerse them for a period of five minutes in the solutions of varying strengths. The ordinary strength of the bluestone solutions generally used would be about 1 lb. of bluestone to 60 lb. of water=1 lb. of bluestone to 6 gallons of water.

Solutions of 1 to 2, 1 to 3, 1 to 4, 1 to 5, 1 to 6, 1 to 7, and 1 to 8 gallons were used. When sown under rather dry conditions the highest percentage of plants which grew reached 58 and the lowest 23, whereas the untreated grains averaged 86 per cent. In every case the solutions were effective in destroying the bunt, all the surviving plants being perfectly clean. Of the untreated an average of 30·5 per cent. of bunty plants were found.

Solutions of formalin were also tested, that used at the strength of 1 lb. of formalin to 400 lb. of water, the grain being immersed for five minutes, allowed of an average of 71 per cent. of plants to mature, ranging from 68 per cent. to 75 per cent. ; in only one instance were bunty plants found by using this solution of the above strength. In one instance a solution of 1 lb. of formalin to 300 lb. of water was used, allowing of 76 per cent. of plants to mature which were bunt free.

The Jensen hot water treatment was also tested, this treatment being to immerse the grain in hot water kept at the temperature of from

130° to 135° Fah. for fifteen minutes, afterwards dipping it into cold water. The percentage of plants which grew was 86 per cent., equalling the number of the untreated, and all were free from bunt.

The results of the various experiments have proved that the bluestone method is very unsatisfactory for the drier districts as considerably more than 50 per cent. of the grain may be destroyed by solutions of the ordinary strengths. Owing to the fact that solutions which may prove satisfactory under certain conditions may prove deleterious under others, it is extremely difficult to recommend strengths for the varying degrees of moisture.

Formalin was found to be preferable under unfavourable conditions, and could be recommended as a substitute for bluestone.

It was also proved that the formalin solution did not deteriorate when left in an open vessel for one week.

Formalin can be puchased at 2s. 6d. per lb., and as 1 lb. will make 40 gallons of solution, it possesses the advantage of being cheap. It is poisonous and a powerful disinfectant.

The Jensen hot water treatment is decidedly efficacious, andin the hands of careful operators is to be recommended.

Care must be taken to keep the water at the stated temperature, and also to thoroughly cleanse the machinery from bunt spores before sowing.

The Effect on the Germinating Quality of Seed Wheat Treated with Blue Stone.

In order that some reliable data may be obtained in this matter, it is the intention of the Department of Agriculture to institute experiments to test in an exhaustive manner the germinating quality of treated in comparison with untreated seed.

Farmers are invited to assist in this matter by forwarding to the Department samples of untreated and treated seed—about an ounce of each—taken from bulk ; accompanied by an account of the manner in which the treatment was carried out.

It is believed that by this means a large number of samples will be obtained and some accurate and reliable information on this very important matter will be made available.

Artesian Water Supply.

MECHANICAL POWER DERIVABLE FROM ARTESIAN BORES.

W. GIBBONS COX, C.E.

THE mechanical power derivable from the pressure given in the outflow from artesian wells, although it varies in different bores, is a constant mechanical asset, the value of which is little understood in Australia, and its prospective value, when the bores become multiplied over the face of the land, can scarcely be estimated or realized.

Taking the bores already in operation in New South Wales and Queensland alone of the Australian States, we find as follows:— Number of flowing bores in New South Wales and Queensland, 790; total outflow per diem, 535,500,000 gallons. They are all flowing in accordance with the well known laws of hydraulics—the movement and pressure of water. The outflows with their attendant pressures at point of discharge are caused by the floodwaters entering the outcrop areas of the artesian water-bearing rocks at a higher level than that of the surface at the site of the boring, and the enormous quantity of water contained in the rocks lying above the level of the bore site produces pressure sufficient to force the water above the surface at any point where a vertical bore is made to the water-bearing rock.

The following statement from the Government reports gives the pressure and resultant horse-power at some of the bores:—

NEW SOUTH WALES.

(Measurements have not yet been made of many of the bores of this State.)

Bores.	Static Pressure in lbs. per sq. in at surface.	Maximum potential horse-power.
Enngonia	165	15·10
Coonamble	85	7·10
QUEENSLAND.		
Northern Railway	123	13·96
Beaconsfield	39	3·36
Brighton Downs	129	12·00
Dagworth	41	5·23
Eddington ...	143	22·60
Eulolo	84	5·70
Nullingera	85	12·60
Telemon	45	5·77
Blackall	—	8·04
Cunnamulla	—	41·59

No question appears more difficult of explanation than the inconsistencies of the flow from artesian bores. It is generally and erroneously thought that the greater the pressure, and the higher the

water rises above the casing-head, so in proportion is the flow greater. The discharge from an artesian bore depends upon three factors :—

1st. The pressure under which the flow takes place.

2nd. Upon the depth, diameter, and condition of the bore itself.

3rd. And upon the nature and character of the stratum in which the flow is obtained.

The flow from a thick seam of low porosity might be equivalent to a thinner seam of greater porosity. The assertion that the discharge depends upon other things than pressure explains how it is that we find no direct relation between pressure and flow, as instanced in the following table :—

Bore.	Yielding million gallons.	Closed - pressure, lbs. per sq. in.	2in. orifice—pressure, lbs. per sq. in.
Enngonia	0·4	165	20
Belalie	0·6	187	20
Kerribee Creek	1·0	98	80

Application of Power.

One of the sources of power for engines is "water raised to a height by solar heat." Another source is the tides. It will be unnecessary here to pursue an inquiry into the action by which solar heat or soli-lunar tide raises water from any level to a higher level. We start from the fact of its being so raised, only staying to recognize that water, *per se*, has no energy virtue—its mass, and the action of gravity on that mass, are all that constitute the source of energy. The fluidity of the water and the ceaseless cyclic return which Nature causes it to make to the higher level are, however, valuable factors in the practical utilisation of gravitational energy. Otherwise we might erect gravity engines worked by any other falling mass, *e.g.*, rock. The theory of gravitation engines, as applied to water-motors, consists of a portion which will be independent of the special properties of water, and a portion which will include those special properties of fluidity, viscosity or friction, incompressibility, etc., in its subject-matter.

The outcome of very close study, both theoretical and practical, has been the production of the modern water-motor, an apparatus which receives the pressure power from the bore water, or from falling water, and transmits it into the mechanical power necessary for the purposes in which steam, horse, or manual power has hitherto been mostly in use.

Hydraulic Turbines.

An hydraulic turbine is a rotary engine, in which the mechanical power is developed by the energy of velocity, or of pressure, of water.

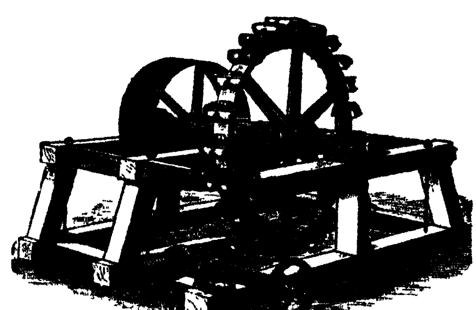
The essential parts of a turbine are :—(1) The *guide blades*, which are fixed curved guides for properly leading the water into the rotating part of the engine; (2) the *vanes*, which consist of curved

plates arranged around the shaft, and rigidly connected to it, the space between the vanes forming passages, wherein the water exerts its propelling force; and (3) the *shaft*, to which the circle of vanes is connected, and around which the vanes revolve. The passages necessarily communicating with the turbine are (1) a passage leading from the flume, or the outflow pipe of the bore, to the spaces between the guide blades; and (2) a passage leading away from the discharge end of the vane spaces to the suction tube or tail race. In some types of turbines the passages are definitely formed by pipes or channels, in others they are merely formed by the natural unconstrained flow of the water into or away from the engine. The different possible arrangements of the vanes and guide blades give rise to several distinct classes of turbines, and constitute one of the chief grounds of the differences of action of this type of engine.

The Pelton Wheel.

Where power is to be derived from an extremely high fall, or from high pressure from artesian bores, the use of ordinary impulse turbines and of reaction turbines is rendered impossible; the one because of the enormous stresses which would be set up in the machinery, the other because of the prohibitively high speed which would be developed. On such falls or pressure the simplest construction of engine is desirable, and one in which a reasonably high speed is obtained without undue strains on the working parts. Such a form of engine is found in the Pelton Wheel, if this be intelligently designed.

A general view of one form of this engine, which has found extensive use in the mountainous districts of North and South America, is shown in the illustration. The engine consists essentially of a stout wheel, upon the periphery of which a number of specially shaped Pelton buckets, or vanes, are secured together, with one or more jets of water directed from nozzles almost or quite tangentially against the lowermost vanes. The wheel is rotated by the impulse of the rapidly moving jets, and the power developed is conveyed through the shaft. The



power is regulated by a sliding valve, or sluice, behind the nozzle. The vane or bucket used in the Pelton wheel is of the form shown in the illustration. The action of this shape of vane is to divide the jet into two equal parts, each of which glides over the curved surface of the vane, and is deflected backward until it is discharged from the wheel with practically no velocity.

From a report made to the Franklin Institute, it appears that Professor R. E. Browne, of California, has obtained an efficiency of 82·5 per cent. with this form of vane—the Pelton wheel—working

under a head of 50 feet with a ⅜ inch nozzle. One of the highest, if not the highest, fall under which Pelton wheels are working, and the highest fall utilised by any turbine, is at Comstock, in Nevada, U.S., where six large Pelton wheels are running under a head of 1,680 feet, developing power for electrical transmission, the efficiency of the wheels being, it is said, over 80 per cent. The advantage of such high falls lies in the small quantity of water required, but the pressures which are developed in the head pipes are enormously high. The head at Comstock develops a statical pressure exceeding 900 lbs. per square inch, and from a nozzle not more than ½ inch in diameter, driving a 3-foot Pelton wheel at 1,150 revolutions per minute, about 100 horse-power is obtained.

In falling water, as shown in the above, the water in a state of pressure from gravity is led through nozzles into the vanes of the Pelton wheel. In artesian flows the water is likewise led into the vanes, also in a state of pressure, due to gravity of the body of water held in the water-bearing rocks lying above the level of the bore site, so that, in practical effect, there is no difference between the two sources of supply, the final application being in both cases the same. They both produce the necessary water pressure on the Pelton wheel.

On the Continent of Europe, and in America, the utilisation of water-power has been not only carried on successfully—in individual places on a gigantic scale—but the number of large and moderate-sized water-power plants for electric purposes alone is enormous. In a list published by a leading New York paper, 152 is the number which have been installed, and in Switzerland 52 per cent. of the numberless installations in that country are driven by water-power.

It is needless to point out that New South Wales—particularly the coastal lands, both north and south—is munificently endowed with natural water-falls from the ranges, which offer similar water-power to that of America and Europe.

The power derivable from artesian flows in Australia is both ubiquitous and unique. It is cropping up in out-of-the-way inland places where steam-power is not payable, and ordinary falling-water-power is out of the question. The power is direct, and one of the most economical conceivable. To meet the requirements of the numberless operations from running a sewing-machine or a cream separator, to a saw or flour mill, and for extinguishing fires, it is most desirable. By the application of the power to motors such as the Pelton wheel the possessor of an artesian outflow may be held to be fortunate in the extreme. The power being free from working expenses in its production should ensure a large use of it in the near future. It is very largely used in America for the above purposes, as well as for those of electric lighting. It is also largely used there for running sheep-shearing machines.

At the city of Aberdeen, U.S.A., it was difficult, owing to the level character of the surface, to get drainage for a sewerage system. By the advice of B. Williams, civil engineer, of Chicago, the sewerage was conducted to the outskirts of the city into a deep deposit chamber.

An artesian well was then sunk in the pump-house. From the top of the well the water is conducted, under its natural pressure, to the turbine pumps, which raise the sewerage from the deposit chamber, through a height of 23 feet, at a rate of over 2,500,000 gallons per diem. All this by the direct pressure of an artesian well, that cost £680, was sunk in less than 90 days, works automatically, requires no other attention than that of one man to oil the pumps, requires no special building, needs no repairs, and costs nothing to maintain.

The power is also being utilised in South Dakota for working flour mills. In one mill, with a small bore of 4 inch, from 50 to 60 casks of flour are ground per diem.

The very successful work which has been done in Queensland, where the western townships of Cunnamulla, Charleville, Thargomindah, and Barcaldine have been reticulated with a water-supply under pressure from the several bores, and for fire-extinguishing purposes (Thargomindah having in addition an installation of 50 electric lamps), shows what the pressure is capable of, and that part of that pressure might be diverted to running water-motors for ordinary purposes.

The Pelton wheels are very small, and an extremely economical medium of power. The price is at the rate of £12 10s. per foot in diameter of wheel. A 2-foot wheel, costing £25, will give with a pressure of 150 lbs. per square inch, about 38 horse-power.

This water-motor only utilises the pressure of the outflowing artesian water, which, after it has effected its purpose, passes away into the ordinary channel without any diminution of its volume, but with a value enhanced in the degree of its far greater economic utility though the additional work it performs.

(Block lent by JAMES MARTIN & Co., Sydney.)

AN EFFECTIVE FIRE-BEATER.

A VERY effective fire-beater is made by attaching an oblong-shaped piece of greenhide, size about 2 feet by 12 inches, to a handle about 4 feet long.

It is easy to use, and does not tire the user like the bag, and it does not wear out like the green bush. One will last many years.

The handle should be so attached to the piece of hide that when used the hide will flap on the ground.—C. J. CROCKER, Inspector of Stock, Mudgee.

THOSE who have tried it say that it pays to keep a cow cleaner than a horse. This takes work, because a cow is naturally more unclean than a horse. They do not hesitate to lie down with their udder in a heap of manure. It should be carefully washed, and the flanks should be brushed, so that as little dirt may get into the pail as possible.—*Texas Stockman and Farmer.*

Notes on Ringbarking.

W. MACDONALD.

ADMITTING the necessity of ringbarking, suckering, &c., in order to increase the grazing capacity of the land, the excessive and indiscriminate manner in which it is too often carried on in the Tamworth, Gunnedah, Coonabarabran, and Bingara land districts appears to call for serious consideration on the part of our legislators; and the same may be said with regard to our forestry laws generally, the act having proved lamentably ineffectual, both in its intention and administration. The conditions are inadequate for the protection of young timber of prospective value, and the maintenance and preservation of such timber for future requirements. Large areas are being denuded of forestry growth by the present holders of Crown lands, without even saving enough for shelter and other requirements during their tenure. Such destruction must ultimately prove seriously detrimental to incoming tenants or purchasers of the freehold as well as to the land and public interest generally. Our best grazing lands are often found to be thickly timbered with inferior varieties (*i.e.*, crooked, stunted growth of box, ironbark, pine, &c., and many inferior varieties of scrub woods), and although not containing much timber of commercial value, I do not know of any forest holding incapable of producing a sufficient supply of useful timber for present and future lessees or owners in fee-simple for all time under proper restrictions and maintenance. It is, perhaps, difficult to connect the necessary conservation of timber with pastoral tenants, the former under existing conditions being ruthlessly sacrificed in the interest of the latter, as the ordinary grazier considers that the more timber he kills the more grass he will have for his stock; but it is certainly not so, and there are many experienced graziers who will endorse the opinion that the best grazing land, taking average seasons, drought-resisting qualities, and carrying capabilities into consideration, is that which bears a due proportion of timber in groups and belts throughout the area. Certainly, the effects produced by ringbarking are marvellous and somewhat misleading, resulting not only in a spontaneous growth of grass, followed in many places by suckers and seedlings, which prove often very expensive to eradicate, but sometimes also in the production of springs. This extraordinary effluence of subterranean water is very encouraging to the grazier, and he congratulates himself upon the phenomenal improvement he has effected. Such effluences are not permanent, and sooner or later they disappear by re-absorption.

Admitting that forests absorb a great deal of moisture from the soil, the fact must not be lost sight of that they also attract and absorb a great deal from the clouds, and that the falling leaves and

debris have some beneficial fertilising and hygienic effects. The scarcity, coarseness, and acidity of the grasses in a virgin forest are not altogether caused by absorption of moisture from the soil, but more particularly by the obscurity of light and heat. It will be observed in a ringbarked forest that, notwithstanding the growth of suckers from the box, stringy-bark, and other eucalypt varieties, which within four years will in many places develop into formidable saplings 4 to 6 feet from the stump of the parent tree, the grass continues to grow round about the very roots; and during the late disastrous drought it is well known the heaviest losses in stock were on the plains and forest lands that had been denuded of all forest growth; and in forests of even inferior country where paddocks were small and provided with a plentiful supply of water the percentage of losses was comparatively small. What I desire to point out is that the most beneficial effects may be produced in the interest of the grazier, not by a wholesale and wanton slaughter of the timber, but by what I will endeavour to describe as discriminate ringbarking, suckering, and thinning-out.

In forests where straight trees and saplings are few and far between, the most useful varieties should be carefully saved; and the word "straight" should apply to any sound tree or sapling having one or more straight lengths of, say, 7 feet, or likely to grow into such dimensions. Timber should be carefully preserved along the banks of creeks and watercourses, and on the tops of ranges and hills, as well as along boundary fences, also groups on all the most suitable and favourite camping grounds for stock; and where the timber has already been ringbarked in such places, the suckers and seedlings should be allowed to grow up again where they will, so as to form the necessary shelter.

We often hear it said in connection with ringbarking applications, "There is no timber of any value on the land." I have never in the course of my travels seen forest-land without timber of value, both present and prospective, for fencing, building, and various other purposes other than the necessary shade and shelter; and in this connection I desire to point out that the most inferior box, pine, and ironbark forests by a legitimate use of the axe are capable of producing straight and useful trees—that is, by careful selection and preservation of the straight plants out of the spontaneous growth of suckers and seedlings which judicious ringbarking so frequently produces. I have often observed that crooked old trees of no value will sometimes within a period of a few years after being ringbarked produce straight saplings both in seedlings and suckers. The crooked and inferior ones only should be destroyed, and the straight shoots likely to be of prospective value saved; and by such thinning-out of all crooked and useless plants a practical system of re-afforestation would be maintained, and the necessary supply of timber for incoming occupiers for all time. The valuable object-lesson which Nature so clearly teaches us in a ringbarked forest warrants serious attention. It is worthy of note, and and it is intended to show man that the timber is there for a wise purpose; and, if he is not regardless of Nature's laws, the requirements

of his children, or those who may succeed him, he will soon be able to see the practicability of highly improving his holding, either for grazing or agriculture, and at the same time improve and maintain the necessary timber supply for all purposes, and for all time.

No special or scientific knowledge is required in this connection, but simply practical experience and common sense. There is no doubt that green timber, being a slow conductor of heat, moderates the temperature, condenses moisture from the clouds, and shelters the soil both from cold and hot winds; and the eucalypt varieties, which form the bulk of the forests throughout the states, help considerably to mitigate malarious influences. We learn how Southern Europe was utterly depopulated owing to wholesale destruction of the forests, where the soil was washed away, rivers became filled with sediment, and the population was involved in ruin. Experience has amply proved that the productiveness of fields, both grazing and agricultural, is increased considerably by shelter belts, and the most productive crops of maize and wheat are found under shelter of the forests and specially from the westerly winds. The injurious effects of excessive ringbarking are already experienced and acknowledged by many selectors whose holdings I have inspected; and now, when it is too late, they regret having destroyed so much valuable timber.

I have endeavoured to show how the grazier may most beneficially improve and maintain the carrying capacity of his forest-land, and at the same time improve and maintain such forest growth as may be necessary to supply his present requirements and those of incoming tenants for fencing, building, and other purposes, and for the shelter of his stock and crops; how he may also by a discriminate use of the axe embellish the landscape. Let them contrast this picture with the cheerless aspect of an open plain or treeless ridges.

I close my remarks with a quotation from the works of that eminent scientist the late Baron von Mueller, as they appear to be most applicable to this subject:—

"I regard the forests as an heritage given to us by Nature, not for spoil or to devastate, but to be wisely used, reverently honored, and carefully maintained. I regard the forests as a gift entrusted to any of us only for transient care during a short space of time, to be surrendered to posterity again as an unimpaired property with increased riches and augmented blessings to pass as a sacred patrimony from generation to generation."

Notes on the Question of Forest Conservation.

W. MACDONALD.

REGARDING the question of forest conservation now under the consideration of our legislature, I venture to submit a few remarks, the result of personal and practical observation during my long experience in the bush, and in connection with my duties as forester and conditional purchase inspector. There are large tracts of forest lands in the State of New South Wales, particularly along the seaboard, which are capable of the most successful development and reproductiveness of our best timber trees, provided they are placed under proper control and practical intelligent supervision.

The first step necessary in this connection after permanent dedication of the most carefully-selected and approved reserves should be to strictly prohibit the cutting of young trees, either for mining props or any other purposes, and to insist upon the utilisation of matured timber for such purposes. At the same time all inferior timber (live and deadwood) should be cleared off and the inferior plants thinned out, thereby providing ample space and light necessary for the development of the young trees. I have often observed that the ordinary burning-off of the felled blackbutt and other eucalypts will within twelve months produce an abundant growth of seedlings for a considerable space around the parent tree within the radius of the fire, thus affording a valuable object-lesson from Nature's book, and clearly showing by this spontaneous reproduction how the most economical system of re-afforestation may be established and maintained, requiring no special scientific knowledge or serious outlay of capital, practical experience and general knowledge of our best timber-trees being the chief desideratum. Under the foregoing system of management, we have in our primæval forests abundant material for the production of valuable timber in periodical rotation for all time. But without absolute prohibition of the cutting of young trees and saplings, the best of our forests must soon become exhausted, for it is obvious to the most inexperienced observer that not even the marvellous reproductive powers of the forest between Newcastle and the Hawkesbury can possibly keep pace with the axe and present wholesale slaughter of the straightest and best young trees, which are ruthlessly sacrificed for mining props and other purposes.

The fact that about 2,000 sleepers are required for every mile of railway, and that the best of these require renewing about every fifteen years, how to provide the necessary material to supply our increasing demands under this head alone is a serious question. I do not think foreign countries can sustain the call on their indigenous timbers, much less supply any demands from Australia.

Some Notes from the Wheat Experimentalist.

W. FARRER.

THE paper on the wheat, "Bobs," which appeared in the issues of August and September last, may be supplemented. In it I mentioned that it was rust-free in 1903 at the Hawkesbury College Farm, and it was on that account that I suggested that we might have in it a variety which would prove to be safe to grow in the coastal counties. In 1904, however, Bobs failed to resist this pest at Richmond, as well as at other places in the county of Cumberland, but was, in fact, smitten hip and thigh by the pest. I must therefore withdraw the above suggestion. It has not come as a very great surprise to be obliged to do this, for the mother of Bobs, M. (F.)—at any rate, the strains of M. (F.), which have been tested, have been found to be quite rust-liable. Still the matter is disappointing; but it is nothing more, and this failure cannot be regarded as a final failure to get varieties which will withstand rust in the coastal counties.

In regard to the parentage which I have given of Bobs—viz., M. (F.), and B.S.B., or the wheat M. (F.) crossed by the Bald Skinless (Nepaul) barley, for the purpose of examining into its correctness, I collected last autumn all the different strains I could lay my hands upon of the cross-breds from which Bobs was fixed. These were planted side by side, for the purpose of comparison, and to see whether or not Bobs was, after all, nothiug more than the wheat M. (F.). I found that some of the strains differed from one another quite distinctly, or more than enough to enable me to say that M. (F.) and B.S.B. is a cross-bred (or hybrid), and not merely the mother wheat, M. (F). The differences which were seen most distinctly were in the colour of the unripe heads, which were of a fresh light green in some, while in others the green was much darker and blueish. The ripe heads, speaking generally, resembled very closely those of M. (F.), the unripe heads of which were of a dull blueish-green colour.

I was not fortunate enough to get any plants from the cross Bobs and B.S.B.—or Bobs crossed by B.S.B.—which I could identify with certainty as being cross-bred, neither have any such been secured from the attempts which were made last season to effect this cross. This makes it look as if Bobs did not contain blood of B.S.B.; but it is too soon to come to a final conclusion.

Some years ago when I attempted to cross some rye-wheats, one part of the blood of which I knew to be rye and three parts wheat, by pollen of rye, I found the cross to be very difficult to make, and this is evidently the case also with Bobs by B.S.B. As bearing, however, on the possibility of Bobs having been produced by crossing B.S.B. on M. (F.), I am able to mention that some seeds which had

been produced by crossing B.S.B. on Federation last season, produced plants which were distinctly different from the mother variety which was growing from uncrossed seed taken from the same plant, and planted at the same time in the next drill and immediately adjacent. The plants which were identified as cross-bred, or hybrid, resembled each other closely, and differed from Federation in being taller, and in having heads which were of a distinctly lighter (amber) colour, and were somewhat more open. A plant, also, from a cross between another wheat-barley and Federation, produced a plant which differed in much the same manner from the mother (Federation). This latter wheat-barley, I may mention, was derived from a stray seed which was found in a sample of wheat from the Volga country of Russia. It is a very productive sort, but is spoiled by the weakness of its straw.

The cross which, I believe, gave us Bobs has been made again this season at Wagga by my assistant there, Mr. R. J. Hurst. These (three) seeds have been secured from it, all of which resemble that from which Bobs came, in being small and pinched. It is needless to say that every effort will be made to make them grow.

It will be remembered that several attempts were made in 1902 to cross Fife wheats by B.S.B., and that they all failed; also, that when B.S.B. was crossed by some Fife wheats, seeds were secured, some of which produced plants which at first differed in their foliage distinctly from B.S.B., in being wheat-like, and that they afterwards became indistinguishable from B.S.B. When I left home in August, 1903, these plants which were evidently only B.S.B. and those which seemed to be hybrid, could be distinguished so easily that I did not consider it necessary to record the positions of each in the drill. In consequence of this, when I came back after an absence of about six weeks and found that these differences between the plants had disappeared, I found it impossible to identify the cross-bred. On this account it was necessary to harvest all the plants separately, and to plant the seeds from each in separate drills, in order to distinguish by means of the differences between individual plants which were expected to appear in the variable generation, which of the drills were of cross-breds. As this plan failed, because in every drill every plant appeared not to differ in any respect from ordinary plants of B.S.B., it became necessary to have recourse to another expedient. I have mentioned already that all of several attempts which were made the previous year to cross B.S.B. in pure Fifes failed. This led me to think that although pure Fifes refused to take the pollen of B.S.B., they might not refuse to take that of plants of those drills which were hybrids, for half of the blood of such plants would be Fife, and that in this way we might discover which of the drills contained hybrids. This expectation has not been disappointed, for three seeds have been secured from crosses on Power's Fife from drills which were supposed to be of (B.S.B. and Fife) parentage. As every precaution was taken to prevent subsequent self-impregnation when these crosses were made, I have much confidence in the parentage of these seeds.

In connection with some of the newer wheats, the trials which have been made of some of them since they were sent out, encourage me to recommend them for further trial by farmers. The varieties I am alluding to are—(1) Federation, (2) Tarragon, (3) Schneider, and (4) Plover.

(1) *Federation.*—This is an early variety, and ought to be specially suitable for those districts in which the climate is warm, and straw has little value, and high winds are apt to cause shelling. At both Wagga and Saddleworth (S.A.), Federation has shown itself to be a heavy yielder of grain. It is not a very good resister of rust, but in this respect it is distinctly better than the Purple Straws (Steinwedel, Farmer's Friend, Rattling Jack, Dart's Imperial, and as well as the varieties growing under the name of Purple Straws), and Tuscan's Federation is a good milling wheat, but its flour is hardly strong enough to put it in the straight-flour class.

(2) *Tarragon,* which came from a cross between Improved Fife and Tardent's Blue, gave the heaviest yield (38¾ bushels) of all the varieties which were grown last season at the Bathurst Farm. It is rather a late mid-season variety, with good, but a trifle open bald head, and its straw is of excellent quality. Tarragon is not likely to prove suitable for warm districts, but to do well on the table-lands, where it ought to make a good hay wheat. Its milling qualities are good, and it yields a high percentage of flour of sufficiently high strength to place it in the "straight-flour" class.

(3) *Schneider* and (4) *Plover* cause the same cross, and three-quarters of their blood is purple straw. They are both superior to that variety in their ability to resist rust, but resemble it in most of their other qualities, and notably in the character of their grain. Thus far Schneider has generally shown itself to be rather the better yielder. (It came third at Ballarat last season with 34¾ bushels per acre, while Plover yielded only a trifle over 31), but this may only mean that it has been more fortunate in finding soil or season, or both, to suit it. Of the two, before they were sent out, Plover was my favourite. Both have straw of excellent quality, and produce it in sufficient quantity to be good hay-wheats, and both find a place in the "weak-flour" class.

Cattle Feeding in times of Drought or during severe Winters.

M. A. O'CALLAGHAN.

JUST now many dairy farmers and dairymen who supply Sydney with milk will be interested in the question of what is a good ration for milch cows. In order to maintain a cow in full milk she must have a certain minimum quantity of nutritious matter, and this quantity has been pretty accurately determined by scientific work carried out in various parts of the world. Apart from nutrition she requires a certain amount of bulk, the ordinary food of the cow being of a very bulky character. The food must also contain enough water to make it palatable, and to aid digestion. The silo or ensilage stack should be the farmer's savings bank, and no farm of any pretentions should be without one. Hundreds of farmers no doubt now realise that they ought to have conserved fodder very largely in this manner last autumn, when supplies of green fodder were plentiful. However, there is no use in crying over lost opportunities. The point is, how shall dairy cattle be best fed with the foods now at our disposal?

The following rations may help some thoughtful farmers to work out this problem:—

RATIONS suitable for cows of average size in full milk.

No. 1. 30 lb. maize ensilage.
10 ,, millet hay.
4 ,, crushed oats.
7 ,, bran.

This gives a total of 51 lb. fodder, containing 25 lb. of dry matter, in turn containing 1·92 lb. of digestible albumenoids, 13·33 lb. of digestible carbohydrates, and 0·64 lb. fat, with an albumenoid ratio of 1 : 7·6.

No. 2.	30 lb. maize ensilage.	Total fodder,	53½	lb.
	15 ,, lucerne hay.	Dry matter,	27·55	,,
	6 ,, bran.	Albumeroids,	2·34	,,
	2½ ,, crushed maize.	Carbohydrates,	13·31	,,
		Fat,	0·64	,,
		Albumenoid ratio, 1 : 6·3		

No. 3. Suitable for districts like Glen Innes, where mangolds grow well, though green maize should always be a cheaper food.

25 lb. mangolds.	Total fodder,	50	lb.
15 ,, lucerne hay.	Total dry matter,	24·76	,,
1 ,, cotton cake.	Albumenoids,	2·56	,,
4 ,, bran.	Carbohydrates,	12·67	,,
5 ,, maize meal.	Fat,	0·64	,,
	Albumenoid ratio, 1 : 5·4		

No. 4. Suitable for those near a brewery.

25 lb. fresh brewer's grains.	Total fodder,	49	lb.
20 „ lucerne hay.	Total dry matter,	27·74	„
4 „ corn (maize) meal.	Albumenoids,	2·77	„
	Carbohydrates,	12·67	„
	Fat,	0·72	„
	Albumenoid ratio,	1 : 5·1	

No. 5.

20 lb. pumpkins.	Total fodder,	48	lb
10 „ lucerne hay.	Total dry matter,	29·57	„
10 „ oaten chaff.	Albumenoids,	2·73	„
6 „ bran (wheaten).	Carbohydrates,	12·47	„
2 „ cotton cake.	Fat,	0·73	„
	Albumenoid ratio,	1 : 5·1	

No. 6. 30 lb. sorghum ensilage.
8 „ bran.
2 „ cotton cake (decorticated).
10 „ wheaten chaff.
2 „ crushed oats.

The bran, cake, chaff, and oats might be mixed together (the cake having been crushed), and the whole moistened with warm water preferred.

Total fodder,	52	lb.
Total dry matter,	23·01	„
Albumenoids,	2·14	„
Carbohydrates,	13·85	„
Fat,	0·73	„
Albumenoid ratio,	1 : 5·8	

In all cases the amounts of albumenoids and carbohydrates given here are digestible.

In rations Nos. 1, 2 and 6 green maize and green sorghum can be substituted for the ensilage made from these, in similar weights.

To those having rough fodder like corn-stalks or straw, the following rations will be useful and simple:—

16 „ lucerne hay.
10 „ bran.
3 „ maize meal or crushed maize.

The lucerne hay might be chaffed, and the bran and maize mixed with it. Moisten the whole with warm water, and feed a few hours afterwards. Then, when the cattle are out in the paddocks, if there is not some grass, give about 25 lb. of coarse fodder. If straw is procurable, it can be chaffed and mixed with the other foods. It will give the necessary bulk, besides containing some nutritious matter. This ration would be enough for cows as large as the ordinary cattle of Illawarra.

"BLUE WEED," OR "PATERSON'S CURSE"
(ECHIUM PLANTAGINEUM, LINN.)

Weeds of New South Wales.

Blue Weed or Paterson's Curse (*Echium plantagineum*, Linn.).

J. H. MAIDEN,

Government Botanist and Director of the Botanic Gardens, Sydney.

Botanical Name.—*Echium*, from the Greek *Echis*, a viper; but, says Hooker, of disputed application. Plants of this genus are called in England "Bugloss or Viper's Bugloss"; *plantagineum*, from a resemblance of the leaves to those of the Lamb's Lettuce (*Plantago*).

E. vulgare, Linn., is known in the United States of America as "Blue Weed," "Blue Devil," and "Blue Thistle."

For the origin of the name "Paterson's Curse," see below. I have seen it called "Beggar's Blankets," but the plant usually known by that name is *Verbascum* (Mullein).

Botanical Description.—Genus *Echium*:—

Herbs sometimes shrubby: usually large, stout, hispid or scabrous with tuberous-based hairs. Leaves entire. Flowers white, red, purple, or blue, in spiked or panicled racemes. Calyx 5-partite. Corolla-tube cylindric or funnel-shaped; throat dilated; limb unequally 5-lobed. Filaments unequal, adnate to the corolla below, exserted. Style filiform, stigma 2-lobed. Nutlets 4, inserted by flat bases on the flat receptacle, ovoid or turbinate, wrinkled, scabrid. Distrib.—Chiefly S. Europe and Oriental; species, 20.

E. plantagineum, Linn.; cauline leaves linear-oblong cordate at the base, calyx much shorter than the corolla-tube, cymes elongate, stamens slightly protruded. *E. violaceum*, Brit. Fl. not of L. Cornwall and S. W. of Jersey; fl. June-Aug. Root fusiform, annual or biennial. Stem 1-3 ft., erect or ascending, diffusely branched. Leaves radical 4–6 in., lanceolate, petioled; cauline spreading, obtuse, sometimes dilated at the base. Cymes 4-6 in., spreading, curved. Calyx-lobes subulate-lanceolate. Corolla 1 in., dark blue-purple. Nutlets as in *E. vulgare*. Distrib.—Spain and Mediterranean region to Greece.

I proceed to give the specific description of *E. vulgare* for reasons which will be evident presently.

E. vulgare, L.; cauline leaves lanceolate or oblong, rounded at the base, cymes short, calyx exceeding the corolla-tube, stamens much protruded. *E. italicum*, Huds., not of L. *Viper's Bugloss.*—Waste ground on light soils in England: an alien or colonist in Scotland, Watson; S.E. of Ireland; fl. June-August. Root fusiform, annual or biennial. Stem 1-3 ft., erect or ascending below, stout, leafy. Radical leaves petioled, 4-8 in.; cauline sessile, acute, rounded at the base. Cymes 1 in. or more, axillary, recurved, lengthening in fruit, panicled towards the ends of the branches; bracts and calyx-lobes linear. Corolla ¾ in., red-purple in bud, then bright blue, rarely white. Nutlets angular, rugose. Distrib.—Europe, N. Africa, W. Siberia, introd. in N. America. (The Students' Flora of the British Islands, 2nd Edition, by Sir J. D. Hooker.)

Synonyms.—*E. plantagineum*, Linn., is, as Hooker states, a synonym, and *E. violaceum*, Brit. Fl., not of Linn.

If we examine Hooker's descriptions of *E. vulgare*, Linn., and *E. plantagineum*, Linn., we find two important points, viz.:—

E. vulgare :

(1) Cauline leaves lanceolate or oblong, rounded at the base.
(2) Calyx exceeding the corolla-tube.

E. plantagineum :

(1) Cauline leaves linear-oblong, cordate at the base.
(2) Calyx much shorter than the corolla-tube.

Now, if the drawing be consulted, it will be seen that the flowers are those of *E. plantagineum* as regards the important botanical character (2). The arrangement of the inflorescence is also of that species, that of *E. vulgare* being coarser and more crowded.

Coming to the cauline leaves, we find that they are cordate at the base; but if "Illustrations of the British Flora," Fitch and Smith, No. 691, be referred to, it will be found that the cordate base is by no means a prominent character. I therefore name our "Paterson's Curse" *E. plantagineum*, although I admit it is not absolutely typical. But allowance must always be made for a naturalised plant growing under conditions perhaps very different to those of its native country; furthermore, *Echiums* are rather large, coarse plants, and very few herbarium specimens comprise whole plants, including, of course, representative cauline leaves. As a rule, the flowering tops are alone picked off and sent for examination.

Echium is a difficult genus, without a sharp line between some of the species; and it is my intention, if I receive good specimens of the other species acclimatised in Australia, to return to the subject, for the last word has not been said in regard to the Australian forms.

In good land, where the plants are wide apart, I have seen one plant 5 ft. 6 in. high, and up to nine flower-stalks on each, but where it has been established some time it grows as close together as the wheat plants in a crop, and does not stool at all - just grows one straight stalk.—E. A. HAMILTON, Cumberoona, *vid* Albury.

Fodder or other uses.—

It is in no way injurious to stock; in fact, in the early spring I consider it one of our best fodder plants, as the first leaves are very succulent, and it is the quickest-growing plant during the frosty weather. When the plant matures, however, the flower-stalk is very rough and hairy, and the stock will not eat it: and then, when it seeds and dies off, all the grass is killed underneath, and there is nothing left on the paddock at all.—E. A. HAMILTON.

That "Paterson's Curse" produces some feed is undoubted, but it is a smothering, rough, coarse plant, whose room is far better than its company. I will deal with the value of the plant in the next section; the vernacular name "Curse" shows what many people think of it.

How to get rid of it.—The intensely bristly character of this weed calls for its destruction wherever it appears. It should be cut out with hoe or mattock before it seeds, wherever it begins to make its appearance. Being quite an ornamental plant when in flower, it has been spared for sentimental reasons; that is the danger in the case of a weed such as this.

Both sheep and cattle eat the plant when there is little or no other feed to be had. Mr. P. Hore, of Mugwee Estate, kept a number of sheep in a small paddock last spring that was covered with "Paterson's Curse," and the sheep completely eat it out,

and the sheep appeared to do well on it. The worst of the weed is that it chokes all other vegetation, and neither grass or other vegetation will grow near it; and when it dies the ground is left black and unprofitable.—Mr. F. FRENCH, Inspector of Stock, Albury, 18th April, 1904.

A neighbour of ours has got rid of it in a small paddock by running a very large mob of sheep on it and eating it quite bare several times in the year, so preventing it from seeding. By doing this for three years he has his paddock free from it, with the exception of a few plants, which he pulls up as they appear. It is hard to estimate the damage it is doing here, as people have not yet begun to try and get rid of it; but I offered 6s. per acre to have it hand-picked last spring, and it was not accepted. Our neighbour offered a party of Syrians work pulling it up, and they wanted 13s. per acre.—E. A. HAMILTON.

Where found.—

This weed was introduced to this district by the people (Patersons), who lived in a small farm adjoining this estate, as a garden flower about twenty-five years ago. It did not spread much at first, but grew out on a small hill near the house, gradually enlarging every year. However, about eight years ago it got through the fence on to a travelling stock reserve and into our paddocks. Then, as soon as the stock began to travel through it, it spread very quickly, and now it is all over the district, particularly on stock routes and reserves, being carried to these by the stock. There is one patch of about 100 acres in this property, where it is growing as thick as possible; and there the plant merely sends up one flower-stalk to a height of from 1 to 3 feet, but where the plants are growing thinner it grows (on good soil) to a height up to 5 feet, and with a spread across of about 3 feet. Along the road for about 4 miles it is one blue stretch. The plant has spread right up to the head of the Murray, and some local drovers told me they saw it growing at Bourke.—E. A. HAMILTON, Cumberoona, *viâ* Albury, 15th March, 1904.

There is no question that the plant is spreading. I have seen it or heard of it on reliable evidence from many of the drier parts of this State. Some localities have already been given; others are Dubbo, Nyngan, Paldrumatta Bore, *viâ* Wilcannia. In Victoria, like New South Wales, it comes from the Upper Murray. It also comes from Geelong. In South Australia it has been sent from the Flinders Range. We have much to learn of its distribution yet.

The country it thrives best in is a rich black soil river frontage country; and the Upper Murray, Cumberoona, Wagra, and that locality, situated from 17 to 30 miles from Albury, is where it is to be seen in the spring growing most luxuriantly, and the purple flower in the valleys, as seen from the surrounding hills, is exactly like water in a lake.—INSPECTOR OF STOCK, Albury.

I have noticed it invariably in close proximity to main roads, being the inference that it was brought there by travelling stock; and the largest extent seen by me was in Cumberoona, about 17 miles above Albury, on the Upper Murray Road. *One* patch must have covered something like 100 acres, at a rough estimate. Wherever the plant gets a fair hold it completely smothers the grass.—A. H. CHESTERMAN, Staff Surveyor.

I am forwarding, under separate cover, a herb which has, according to report, only appeared on the plains here during the last two or three years—that is, since the sheep came back after being away during the drought. My object in writing is to inquire if it is poisonous, as it is very thick in the wheaten hay crop; and, if not, if it is good feed for stock? At present the stock will not touch it, and, if it is poisonous, can any means be suggested for its eradication, since there are so many patches of it hereabout?—H. P. SMITH, Illilawa, Hay, 1st November, 1904.

REFERENCE TO PLATE.

"Blue Weed" or Paterson's Curse (*Echium plantagineum*, Linn.).

A. Inflorescence.

B. Corolla split and opened out.

C. Ovarium with style.

Quality of some New South Wales Butters on their arrival in London.

M. A. O'CALLAGHAN.

SOME months ago this Department sent a letter to every dairy factory in the State, in which it was pointed out that our Commercial Agent in London, Mr. C. C. Lance, would undertake, as far as possible, to report on each shipment of butter made; and that factories could, if they desired, obtain a confidential copy of Mr. Lance's report. Many factories availed themselves of the opportunity of ascertaining from an unprejudiced source the condition of their butters on their arrival in England; but many factories, for reasons best known to themselves, made no request to have their butters examined. The reports have been very interesting so far, and there is abundant evidence that factory managers are paying much more attention to the grading of cream intended to make export butter than they did during the previous export season, when complaints were very numerous.

The following reports received by factories will be of interest to butter-makers and farmers, and as there is nothing of an inferior character, the reports can only do good to the factories concerned.

Brand.	Flavour.	Texture and Make.	Colour.	Salting.	Packing.	Condition.
			Ex S.S. "Britannia."			
"Laurel," Camden Park	Very good	Good and dry	Correct	Correct	Very good	Good.
Stockman	Good	Good	"	"	"	"
Smithtown	"	"	"	"	Nicely got up	"
"Fern," Bemboka	"	"	A shade high	"	Nicely finished	"
			Ex S.S. "China."			
"Crown," Gerringong	Good	Good	Correct	Correct	Good	Good.
			Ex S.S. "Ortona."			
Cootamundra	Good	Good	Correct	Correct	Good	Good.
Albury	"	"	"	"	"	"
Uralba, Ballina	"	"	"	"	"	"
			Another factory with a bad report.			
A.	Fair	Poor; not sufficiently worked.	Correct	Correct	More care required; paper too thin.	Good.

Wheats grown at Bathurst Experimental Farm, 1904.

R. W. PEACOCK.

	Variety.	Previous Crop.	Area.	Date sown.	Seed sown per acre.	Date harvested	Yield per acre.	Rainfall during growth.	Rainfall for year.	No. of Paddock.
			acres.		lb.	1904.	bus. lb.	in.	in.	
Comparable.	*White Hogan ...	Rape . . .	1	13 April	25	1 Dec.	35 41	10·59	18·26	2
	*Tarragon . .	"	1	13 "	25½	5 "	38 43	10·59	18·26	2
	*Australian Talavera	" . .	1	13 "	24½	5 "	28 21	10·59	18·26	2
	*White Tuscan . .	"	1	13 "	25	2 "	33 17	10 59	18·26	2
	*Sussex . . .	" .	1	13 "	26½	3 "	32 27	10·59	18·26	2
	*Cumberland	" . .	1	11 "	26	5 "	30 45	11·31	18·26	2
	*Plover	"	1	11 "	26	6 "	31 1	11·31	18·26	2
	*Cleveland .	" .	1	11 "	24½	6 "	26 21	11·31	18·26	2
	*Schneider	"	1	11 "	24	30 Nov.	34 55	11·31	18·26	2
	*Power's Fife .	" . .	1	9 "	25½	13 Dec.	28 57	11·46	18·26	2
	*John Brown	"	4·78	8 "	25	15 "	31 45	11·46	18·26	2
	*Steinwedel ...	Half Rape and half Field Peas.	8 90	5 "	25	9 "	32 24	11·31	18·26	2
	*Bobs	17 acres bare fallow, balance Field Peas.	18·63	28 Mar.	24½	5 "	27 48	12·43	18·26	2
	†Hudson's Early P. Straw	Spring Rape	13·27	10 "	24	28 Nov.	16 24	12·43	18·26	19
	‡ " " "	Wheat ...	10	12 May	27	14 Dec.	18 6	10·17	18·26	6
	‡Steinwedel . . .	" . .	8·1	20 April	26	7 "	26 21	10 40	18·26	4
	‡Bobs	Canary Grass .	·63	28 May	30	6 "	24 2	9·67	18·26	Exp. Plots.
	§Mixed varieties . .	Wheats	13 59	..... .	.	. .	19 0	...	...	...

* No manure used. † Eaten off with sheep in June; no manure ‡ A manure experiment.
§ Cut from headlands, &c.

NOTE.—Total acreage, 87 [illegible] acres, total yield, 2,163 bushels, average per acre, 24 bushels 35 lb.

The first eleven varieties are strictly comparable, the land having been treated similarly in every particular. The Steinwedel is not so, as the preceding crop varied over half of the areas it nevertheless was apparently very slightly influenced. Bobs is not comparable to any of the former, it having been sown earlier, and at a time when the weather conditions exercised considerable influence. The whole area also was affected by the disease known as "Take all," which reduced the yield by about 8 bushels per acre. Fully half of the crop died back when about 18 inches high, a second growth taking its place. In order to test the yield of the second growth, a given area was cut off close to the ground on the 14th of September, the second growth being harvested on the 19th December, or 14 days after the main crop; the yield was at the rate of 22½ bushels per acre. This return fully demonstrates the vigour of the second growth, and was exceptional, considering it was cut off so late in the season. The disease is being investigated in order to arrive at some practical method of combating it. The whole of the area of Bobs had been bare fallowed the previous season.

The other wheats grown are not comparable with each other, nor with the former, as they were grown in different paddocks, subjected to different treatments. Some were grown in conjunction with manure experiments, detailed reports of which will be furnished later.

The mixed varieties represent headlands of various paddocks and areas not otherwise calculated for specific purposes.

In paddock No. 2, which has been worked under a system of rotation, the 40 acres averaged 32 bushels per acre, no fertilizers having ever been used.

The areas on which the manure experiments were carried out had been cropped several years previously with wheats.

The Hudson's Early Purple Straw, in paddock No. 19, gave the lowest yield, the germination was somewhat faulty, and the season proved rather dry to obtain the best results from feeding off with sheep. It is in no way comparable with the others.

The season was a comparatively dry one, the rainfall being 6 inches below the average, and proved disastrous to all areas which had not been so worked as to carry over sufficient moisture to allow of the germination of the grain at the most suitable period. Notwithstanding the low rainfall, it could not be said that they were grown under droughty conditions. In the case of paddock No. 2, a considerable amount of moisture was carried over owing to the rape ground having been ploughed early in the preceding summer. Also the land which was bare fallowed contained moisture sufficient to allow of regular germination and the healthy growth of the crop through its early stages during a very dry autumn. This vigorous start allowed of the crops ripening sufficiently early to escape the hot scorching winds of the early summer.

The yields of the varieties are such as could be expected in a very favourable season, and the heavy yields of some of the varieties not considered in any way suitable for semi-arid conditions proves that the results are not valuable as a test of their drought resistance. The wheats giving the highest yields, viz., Tarragon and Cleveland, are not, in my opinion, as suitable as many of the others for the drier districts. The yields prove conclusively the value of good cultivation and rotation of crops in a season such as the one under review.

By such methods alone it is possible to carry over a sufficient quantity of moisture without which it is impossible to get good results.

Hawkesbury Agricultural College and Experimental Farm.

The Pig Industry.

H. W. POTTS.

VII.

Cross-breeding.

The dominating factor in breeding healthy stock, which are vigorous, hardy, good feeders and quick maturers, lies mainly with those to whom the task of selection is assigned.

It is not every pig breeder who is fortunate to possess the intuitive genius of a Bakewell, Booth, or Sanders and Pencer. It is well to remember that a successful application of the breeder's art demands judgment and ability to successfully mate pigs. These qualifications are more emphatically demanded in the selection of cross-bred and grade pigs, and particularly where a breeder is deprived of the aid of pedigree on one side.

Deliberate and wise selection, combined with a proper estimate of the effect of environment, exercise a controlling influence on the progeny and in the ultimate development of those useful qualities which are aimed at. It should be made clear that where cross or grade breeding is practised that the progeny be intended for consumption. So long as interbreeding or in-and-in breeding be avoided, it is safe to affirm that crossing, more especially the first cross, will produce offspring of larger size, greater vigour and hardiness. At this stage breeding must cease. The pigs may be uniform and possess attractive characteristics, but experience warns us to anticipate varied and unprofitable results if breeding from them be persisted in. It is essential to impose limitations when resorting to cross-breeding. It must stop at the first cross. If followed up, degeneracy sets in with its attendant evil results and weaknesses. In every case there should be present a combination of desirable points on both sides. Before proceeding further, it may be as well to define what is really referred to in this chapter as cross-breds. The generally accepted definition is "the progeny of two distinct and pure breeds." The term is often confused with "grades" or "grading." A "grade" refers to the offspring of a pure bred on the male side and an animal of common, mongrel, or mixed blood on the female side. A further term, "high grade," is often used to denote the progeny of more or less pure-bred animals. Better maturing and fattening qualities are as a rule obtained from grade pigs than crosses. They are more reliable, always providing that the grade sows be put to pure-bred boars. In this connection it cannot be too earnestly impressed on the pig breeder the need for "grading up," *i.e.*, to get

thoroughbred pedigreed boars. No animal reverts more rapidly to the wild state than the pig. Most farmers are too ready to test their skill in selecting animals for crossing, and a lessened regard is evidenced for pure-bred stock.

The prepotency of the pure-bred boar is well demonstrated in grading up a herd of pigs or in crossing. It is remarkable to see this effect in the cross of the large or middle pork boar on the Berkshire sow—the suckers are all white. The progeny from a Tamworth sow got by a large black boar are all black, and have the lop ears of the sire. Pure-bred stock breeders are averse to cross-breeding on the reasonable ground that it interferes with the maintenance of true types. The future litters are uncertain if the sows are served with pure-bred boars of their own breed afterwards. The transmission of vitality and sturdiness of constitution, as well as early maturing, have been fully realised in breeding with the Tamworth boar on the Berkshire sow.

It was decided at this College to make a series of tests relating to the crosses. Two pure-bred Berkshire sows were selected, both old, and this was to be their last litter. They were paired by our imported Tamworth boars, "Norman Clinker" and "Middleton Egbert," on the 26th May, 1903. Both sows farrowed on the 15th September; one produced a litter of five and the other seven. As might be naturally expected from old sows almost toothless, the supply of milk was short and not of good quality, and hence the young pigs were not as thrifty as might be anticipated. They were weaned on the 15th November, and on the 23rd November they were weighed and allotted pens, two in each pen. Precautions were adopted to identify each by means of brands. One of our trained students (Mr. Best) was entrusted by our manager, Mr. Daley, with the sole task of accurately weighing the food to the pair in each pen, and to keep the records of all food consumed from the day they were enclosed in the styes until the time of slaughter. The aim was to ascertain the gain in weight, the class of food consumed, the cost, and the exact cost of dead weight in flesh. The following table gives the results:—

No.	Weight when weaned, 23 Nov., 1903.	Weight on 23 Dec., 1903.	Weight on 23 Jan., 1904.	Weight on 15 Feb., 1904.	Weight on 23 Feb., 1904.	Weight when killed, 5¼ mos. old, 29 Feb.	Weight when killed, 6 mos. old, 13 March.
	lb.	lb.	lb.	lb.	lb.	lb.	
1	24	54½	102½	140½	155½	158	. ...
2	22	49	95½	130	144	147½	......
3	19	42½	83	114	125	133½	.....
4	19	41	84	114½	123	131½	.....
5	19½	47	88	125½	136½	142½	......
6	20	53	95	124½	135½	139½	.. ...
7	11	26	57½	90	104	......	125½
8	15½	37	76½	102	116	......	136
9	15½	42	81½	110	120½	... ..	142
10	16½	39½	74½	101½	126	.....	138½
11	16½	39½	84	114½	125	......	151
12	18½	42	69	84	90½	.....	108

On the 29th February, Nos. 1 to 6 were weighed and slaughtered at 5½ months old.

No.	Live Weight.	Dressed Weight.	Offal and Loss.
	lb.	lb.	lb.
1	158	123	35
2	147½	117	30½
3	133½	104½	29
4	131½	100	31½
5	142½	111½	31
6	139½	107	32½

On the 15th March Nos. 7 to 12 were 6 months old, and were weighed and slaughtered and gave the following results:—

No.	Live Weight.	Dressed Weight.	Offal and Loss.
	lb.	lb.	lb.
7	125½	98	27½
8	136	109	27
9	142	112	30
10	138½	109½	29
11	151	117	34
12	108	84	24

AMOUNT AND COST OF FOOD CONSUMED BY EACH PEN.

			£	s.	d.
No. 1 Pen:—					
Pollard	153	lb., at 10d. per bushel	0	6	4½
Bran	5	lb., at 9d. ,,	0	0	2½
Rye	50	lb., at 3s. ,,	0	2	6
Corn meal	134	lb., at 3s. ,,	0	7	2
Oatmeal	273½	lb., at 6s. 3d. per 100 lb.	0	17	1
Wheat	16	lb., at 2s. per bushel	0	0	6½
Milk	78	gals., at ¼d. per gallon	0	1	7½
			£1	15	6
No. 2 Pen:—					
Pollard	129½	lb., at 10d. per bushel	0	5	5
Bran	4	lb., at 9d. ,,	0	0	2
Rye	40	lb., at 3s. ,,	0	2	0
Corn meal	119½	lb., at 3s. ,,	0	6	5
Oatmeal	243	lb., at 6s. 3d. per 100 lb.	0	15	2¼
Wheat	15	lb., at 2s. per bushel	0	0	6
Milk	78	gals., at ¼d. per gallon	0	1	7½
			£1	11	4
No. 3 Pen:—					
Pollard	115½	lb., at 10d. per bushel	0	4	8¼
Bran	4½	lb., at 9d. ,,	0	0	2
Rye	41	lb., at 3s. ,,	0	2	0⅝
Corn meal	121	lb., at 3s. ,,	0	6	5⅝
Oatmeal	240½	lb., at 6s. 3d. per 100 lb.	0	15	0½
Wheat,	12	lb., at 2s. ,,	0	0	4¾
Milk	78	gals., at ¼d. per gallnn	0	1	7½
			£1	10	5½

No. 4 Pen :—

			£	s.	d.
Pollard	114 lb., at 10d. per bushel	...	0	4	9
Bran	3 lb., at 9d. ,,	...	0	0	1¼
Rye	31 lb., at 3s. ,,	...	0	1	6¾
Corn meal	*91½ lb., at 3s.* ,,	...	0	4	11
Oatmeal	*197 lb., at 6s. 3d. per 100 lb.*	...	0	12	3¾
Wheat	18 lb., at 2s. per bushel	...	0	0	7¼
Milk	78 gals., at ¼d. per gallon	...	0	1	7½
			£1	5	10¼

No. 5 Pen :—

			£	s.	d.
Pollard	118½ lb., at 10d. per bushel	...	0	4	11
Bran	3½ lb., at 9d. ,,	...	0	0	2
Rye	30 lb., at 3s. ,,	...	0	1	6
Corn meal	104 lb., at 3s. ,,	...	0	5	7
Oatmeal	207½ lb., at 6s. 3d. per 100 lb.	...	0	12	10½
Wheat	12 lb., at 2s. per bushel	...	0	0	5
Milk,	78 gals., at ¼d. per gallon	...	0	1	7½
			£1	7	1

No. 6 Pen :—

			£	s.	d.
Pollard	113½ lb., at 10d. per bushel	...	0	4	8¾
Bran	3½ lb., at 9d. ,,	...	0	0	1½
Rye	30 lb., at 3s. ,,	...	0	1	6
Corn meal	100 lb., at 3s. ,,	...	0	5	4
Oatmeal	206½ lb., at 6s. 3d. per 100 lb.	...	0	12	10½
Wheat	11 lb., at 2s. per bushel	...	0	0	4¼
Milk	78 gals. at ¼d. per gallon ...	...	0	1	7½
			£1	6	6½

Thus :—

Nos. 1 and 2 cost £1 15s. 6d. in 5½ months	= 240 lb.	= 1·775d. per lb.
Nos. 3 and 4 cost £1 11s. 4d. ,, ,,	= 204½ lb.	= 1·838d. ,,
Nos. 5 and 6 cost £1 10s. 5½d. ,, ,,	218¼ lb.	1·672d. ,,
Nos. 7 and 8 cost £1 5s. 10½d. in 6 months	= 207 lb.	= 1·500d. ,,
Nos. 9 and 10 cost £1 7s. 1d. ,, ,,	= 221½ lb.	= 1·467d. ,,
Nos. 11 and 12 cost £1 6s. 6½d. ,, ,,	= 201 lb.	1·584d. ,,

Further tests are being continued, and those completed include pens of pure-bred Tamworth sows; large black sows; cross-bred middle Yorkshire and Berkshire Borrows. Interesting contrasts are thus afforded in which the cost per lb. of flesh is shown :—

Pen No. 7.—Pure-bred Tamworth Sows; farrowed, 12 October, 1903; penned, 26 December, 1903; killed, 26 April, 1904.

			£	s.	d
Pollard	216½ lb., at 10d. per bushel	...	0	9	0¼
Bran	2¼ lb., at 9d. ,,	...	0	0	1¼
Rye,	116 lb., at 3s. ,,	...	0	5	9½
Corn meal	35½ lb., at 3s. ,,	...	0	1	11
Wheat	29 lb., at 2s. ,,	...	0	1	0
Oatmeal	249½ lb., at 6s. 3d. per 100 lb.	...	0	15	7½
Rice meal	15 lb., at 2s. 4d. per cwt.	...	0	0	3¾
Milk	59 gals., at ¼d. per gallon	...	0	1	2¾
			£1	15	0

Pen No. 8.—Middle Yorkshire and Berkshire Barrows; farrowed, 25October, 1903; penned, December 26, 1903; killed, April 26, 1904.

			£	s.	d.
Pollard	...	191½ lb., at 10d. per bushel	0	8	3¼
Bran	...	3½lb, at 9d. ,, ...	0	0	1½
Rye	...	118 lb., at 3s. ,, ...	0	5	11
Corn meal	...	29½ lb., at 3s. ,, ...	0	1	7
Wheat	...	28 lb., at 2s. ,, ...	0	0	11
Oatmeal	...	240 lb., at 6s. 3d. per 100 lb.	0	15	0
Rice meal	...	15 lb., at 2s. 4d. per cwt.	0	0	3½
Milk	...	58 gals., at ¼d. per gal.	0	1	2½
			£1	13	4

Pen No. 9.—Middle Yorkshire and Berkshire Barrows; farrowed, 25 October, 1903; penned, 26 December, 1903; killed, 26 April, 1904.

			£	s.	d.
Pollard	...	177½ lb., at 10d. per bushel	0	7	5
Bran	...	4 lb., at 9d. ,, ...	0	0	2
Rye	..	103 lb., at 3s. ,, ...	0	5	2
Corn meal	..	27½ lb., at 3s. ,, ...	0	1	6
Wheat	...	29 lb., at 2s. ,, ...	0	1	0
Oatmeal	...	221½ lb., at 6s. 3d. per 100 lb. .. .	0	13	10
Rice meal	...	14 lb., at 2s. 4d. per cwt.	0	0	3½
Milk	...	58 gals., at ¼d. per cwt.	0	1	2½
			£1	10	7

Pen No. 10.—Pure-bred large Black Sows; farrowed, 24 November, 1903; penned, 1 February, 1904; killed, 1 June, 1904.

			£	s.	d.
Pollard	..	217½ lb., at 10d. per bushel	0	9	1
Bran	..	9 lb., at 9d. ,, ...	0	0	4
Rye	...	103½ lb., at 3s. ,, ...	0	5	2¼
Corn meal	.	125 lb., at 3s. ,, ...	0	6	8½
Wheat	...	15½ lb., at 2s. ,, ...	0	0	6
Oatmeal	..	120 lb., at 6s. 3d. per 100 lb.	0	7	6
Rice meal	.	18 lb., at 2s. 4d. per cwt. ..	0	0	4½
Milk		70 gals., at ¼d. per gal. . .	0	1	5½
			£1	11	2

		Live Weight.	Dressed Weight.	Offal and Loss.
Pen No. 7	13	154	122½	31½
	14	159	127	32
Pen No. 8	15	130	101½	28½
	16	158	129½	28½
Pen No. 9	17	111½	90	21½
	18	127	103½	23½
Pen No. 10	19	122	97	25
	20	121½	94	27½

Nos. 13 and 14 cost £1 15s 0d. in 6½ months = 249½ lb. = 1·883d. per lb.
Nos. 15 and 16 cost £1 13s. 4d. in 6 months = 231 lb. = 1·731d. ,,
Nos. 17 and 18 cost £1 10s. 7d. in 6 months = 193½ lb. = 1·896d. ,,
Nos. 19 and 20 cost £1 11s. 2d. in 6 months = 191 lb. = 1·958d. ,,

Grading of the Experimental Plots at the Hawkesbury Agricultural College.

CUTHBERT POTTS,
Lecturer in Chemistry, &c.

It is not proposed to enter into a detailed description of the many bad effects that usually follow the swamping of the soil, particularly when the conditions are such that the excess of moisture cannot readily get away. Such soils soon become sodden, and, depending largely on the wetness of the season, unproductive. In cultivated areas the places that collect water during rain are easily picked out when a crop is growing by the poor growth of the crop at these points. This smallness of crop is sufficient indication of the bad effect of an over wet soil. Further, soils so placed that the surplus water cannot get away quickly, generally cake into a hard crust when they do dry. This last condition is almost as bad as the first. In fact, such soils do not repay the cost of working.

In large farming areas the presence of patches of such soils is not of such great moment; but in smaller operations, orchards for example, it is essential that as much of the land as possible be in good condition. This can only be ensured when the conditions are such as to allow the surplus water to get away rapidly.

Certainly an orchard is generally laid out on a site naturally well drained, and is further improved, if necessary, by a system of open or covered drains.

There are many areas, however, which are so placed as to exclude sub-drainage either from their relative height or from the value of the land. Also there are many minor improvements that could be made which would not involve a large outlay in drainage. In such cases as these a wonderful improvement can be effected by grading so as to obtain a surface flow for the water. Further, most areas that are to be irrigated require grading in order to ensure an even flow over the land.

It might be here mentioned that drainage and grading aim at much the same result from opposite points of view. Drainage allows all the water to soak into the land, and carries off the excess through the soil, while grading by ensuring a good surface flow prevents, to a large extent, the surplus water soaking into the land. Of these two operations grading is probably the cheaper, and drainage somewhat the more effective.

In view of these few points, it may be of interest to give a short account of some work in this direction now being carried out on the experimental plots at the Hawkesbury Agricultural College.

The Grading Scheme.

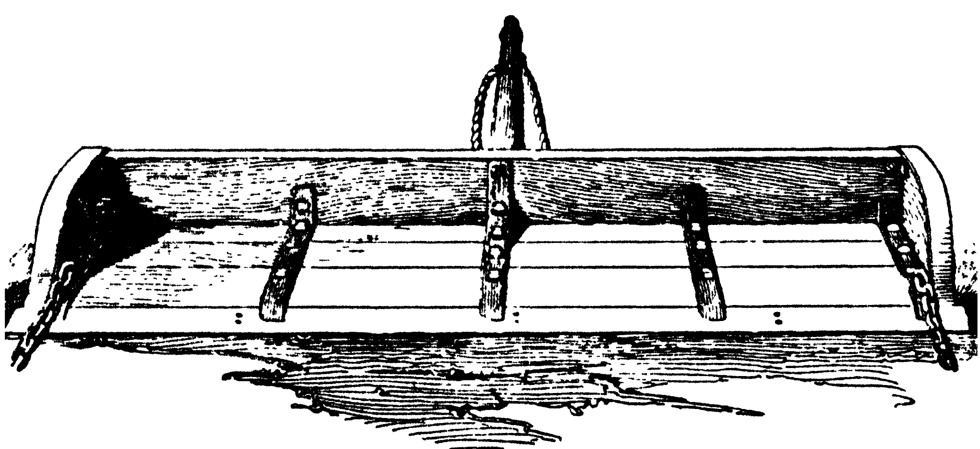
Anyone who has visited the college during, or shortly after heavy rain, and has noticed the experimental plots on each side of the main avenue, will realise what our experimentalists have had to contend

with in the way of experiments spoilt by wet-rotting, and of plots remaining wet so long as to render them useless for a whole season at a time.

The site for the plots is not favourable. The land is possessed of very little natural drainage, the total fall being only about 6 feet over a distance of some 28 chains. Further, there are numerous local depressions occurring, not only in the low-lying areas, but also in the highest parts. These areas become over wet, not only after continued rain, but after short, heavy showers, and in many cases totally destroy the experiments in operation. In view of these facts, Mr. Sutton, our late experimentalist, was determined, by some means or other, to improve the drainage of the plots. With Mr. Sutton, I tried if this could be done by a system of light surface drains, the low-lying nature of the land putting the matter of sub-drainage out of the question; but we soon found that these would not meet the requirements of the case. To make the open drains effective, we found it would be nceessary to alter the gradient of the plots. For this purpose a scheme was drawn up which aims at the alteration of the grades.

Method of carrying out the work.

In approaching the method of carrying out the work, I should like to state that if the grading is extensive it will be necessary to have



the scheme drawn up by a surveyor or an engineer, who will then set out the lines and pegs in the field, as is explained later. On the other hand, there are many cases of simple grading that can be easily carried out without a special scheme being drawn up. The only important point to be kept in view being that a good fall is obtained.

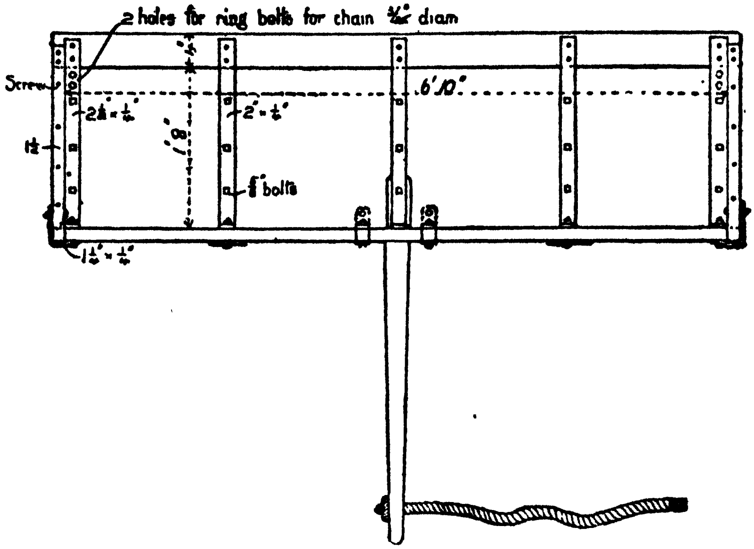
As to the actual moving of the earth, this can be done by the farmer himself, as I think will be seen, if I describe how the grading here is being carried out.

The first thing to be done after drawing up the plans is to set the scheme out on the field. To do this pegs are placed in the field in

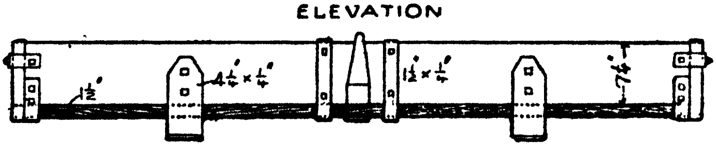
definite positions and at definite heights; the tops of the peg in every case representing what is to be the altered level of the land at that point.

If the land is too high a hole is dug and the peg driven at the bottom of the hole until the top of the peg is low enough. This represents that the earth has to be removed. If the land is too low, then the peg stands above the surface and the grounds must be built up to the top of it. These pegs are accurately placed in with an instrument and are the basis for the field work. They should not, on that account, be moved in any way until the grading is finished. This is very important. Since these pegs are set out at some distance apart, it is

PLAN



ELEVATION

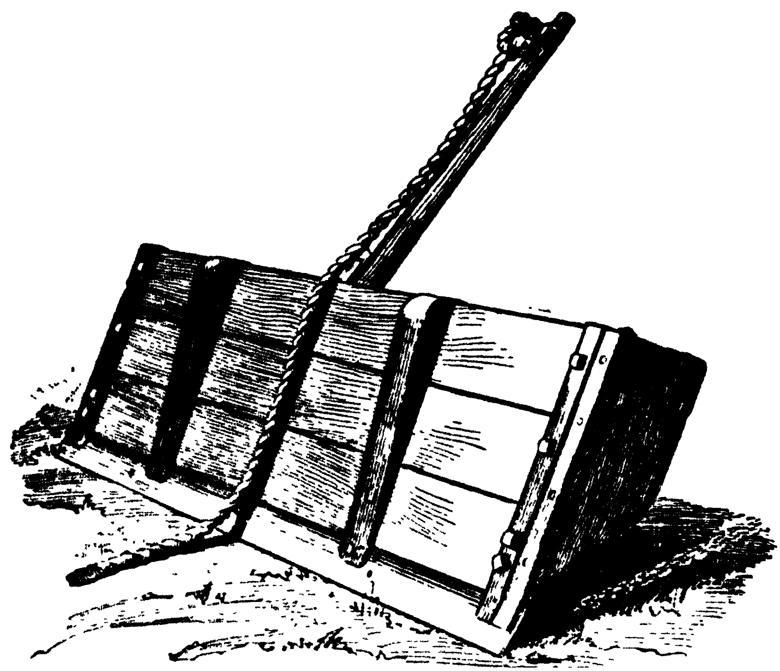


not easy, with the eye, to see if the cutting and filling is regular. To overcome this difficulty boning or sighting rods are used by the men men grading. In this way the men grading can keep themselves correct. The total amount of earth to be moved is about 6,000 cubic yards, with an average haulage of about 5 chains. This involves a considerable amount of work and a considerable time to carry out, especially as the work is only carried out intermittently. But there is this to be said of the work, as of any other grading, the improvement is permanent, and, though apparently expensive at first, will, in the long run, save money.

The earth is being moved with a buckscraper, first described by Mr. W. J. Allen, in this *Gazette*, vol. 9, p. 1316.

The details of the manipulation of the buckscraper, and the effects the grading has on the plots is described by Mr. G. Marks, who now has the work in hand. The following is Mr. Marks' description accompanied with photographs of the work in progress.

In order not to interfere with the various crops and experiments in hand, the work is being carried out in sections, and in slack times, when horses and implements can be best spared. This work is being done by means of the buckscraper, drawn by three horses, and one section of 4 acres has just been completed. The buckscraper used was made at the College, at a cost of about £1 7s. 6d. for the woodwork and £2 2s. 6d. for the ironwork, which includes the equaliser and chains, totalling £3 10s.



The following are the dimensions :—

Length, 7 feet overall ; depth at back, 9 inches ; width, 1 foot 8 inches from cutting edge to inside of back ; cutting blade, steel, 6 feet 10 inches long x 6 inches wide x ¼ inch thick, drawn to a cutting edge.

Length of handle, 3 feet 7 inches from end to scoop, and projecting along the bed for 1 foot 3 inches, being tapered and bolted securely with bolts, having an iron band top and bottom. The handle is made of 3 in. x 3 in. hardwood, and tapered at the end for holding. The timber of the frame is 1½ inch soft wood (Oregon).

As will be noticed in the sketches and photographs, all the edges are shod with iron, so that the surface of the wood may be protected from wear, screws being used on the ends, and bolts for all the other parts. As there is a considerable strain on the handle, very often, in levering, it is necessary that it be made secure, and the accompanying sketch shows how this is done by iron bands bolted top and bottom. The iron bands used are 2½ in. x ¼ in. Underneath are two runners, shod with iron, and these are used to carry the load on when travelling over the ground. The draught chains are 5 feet 6 inches long, made of $\frac{7}{16}$-inch iron, and these are attached, one on each side, as in the sketch, to iron plates about midway from the cutting edges to the

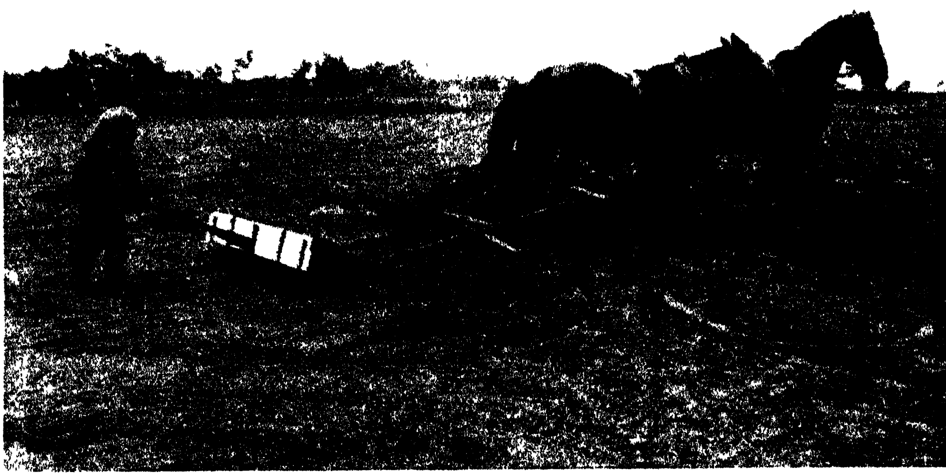


Fig. 1.

back of the scoop. It is important that these chains be fastened at this particular distance, as, in tipping, the edge acts as a fulcrum, and the horses pull the load over with this leverage.

The capacity of this scraper would be about half a cubic yard, though in good loose soil it is often possible to take somewhat more. On account of the uneven nature of the soil, it is not possible to remove much more than the half-yard, as in travelling a great deal of earth would be shaken off. The whole of the work was done with three strong horses, and in a day of eight hours a man and student have removed from between ninety and a hundred loads a distance of 6 chains, equal to about 50 cubic yards.

It is necesary in filling to have the team and scoop square on to the surface to be cut, otherwise the cutting will be done on the one side, and the greater part of the strain will fall upon one horse. To fill, raise the lever gradually and hold firmly. If raised too suddenly the scraper will be simply overturned. The depth of cutting may be guaged to a nicety by careful manipulation of the handle, but a little

practice is necessary in order to become expert. Should the scoop be filled too quickly, there is a danger of breaking some of the chains or bolts.

The photographs will serve to show clearly the various operations in grading.

Fig. 1 shows everything ready for work, and the angle at which the scoop is held in filling. After filling, the scoop is run where desired,

Fig. 2.

Fig. 3.

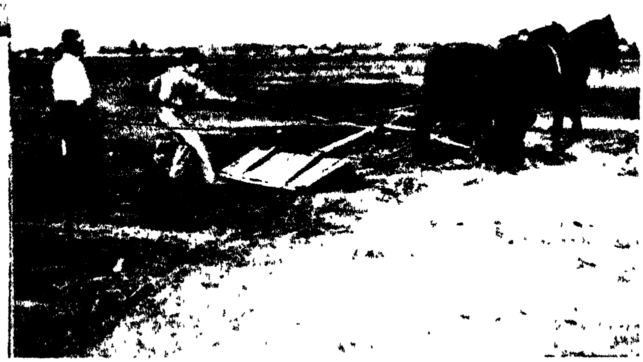


Fig. 4.

carried on the two supports while travelling, levering on the handle as shown in Fig. 2 when crossing depressions.

Fig. 3 shows the load in position for tipping. The load is tipped by lifting the handle while the horses are moving, the edge acting as a fulcrum.

Fig. 4 shows the same load after tipping. Any inequalities on the surface may be removed by standing on top of the upturned grader—the back and edge act as straight edges, and in driving over the land the little ridges are levelled off and drawn into the hollows.

Fig. 5 illustrates on the left a portion of the plots finished and ready for the plough. On the right is shown a portion of the soil yet to be removed.

The removal of a large amount of earth from one particular spot would affect to a greater or less extent the fertility of some of the land for the time being, but, on the other hand, other portions would be vastly improved, and as fast as each plot is finished it is ploughed up, allowed to weather, and then sown down with renovating crops. By sowing such crops as cowpeas, field peas, &c., and ploughing them under as green manure, or grazing them off with sheep or pigs, it is expected in a season or two that the land will be made uniform throughout.

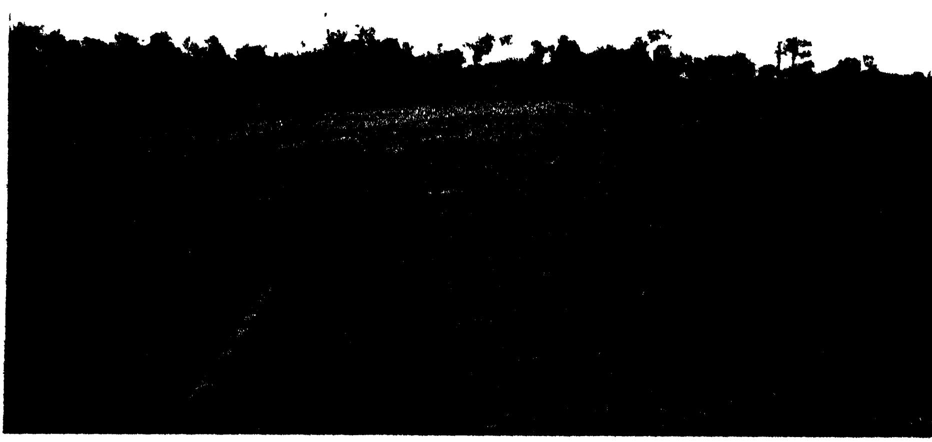


Fig. 5.

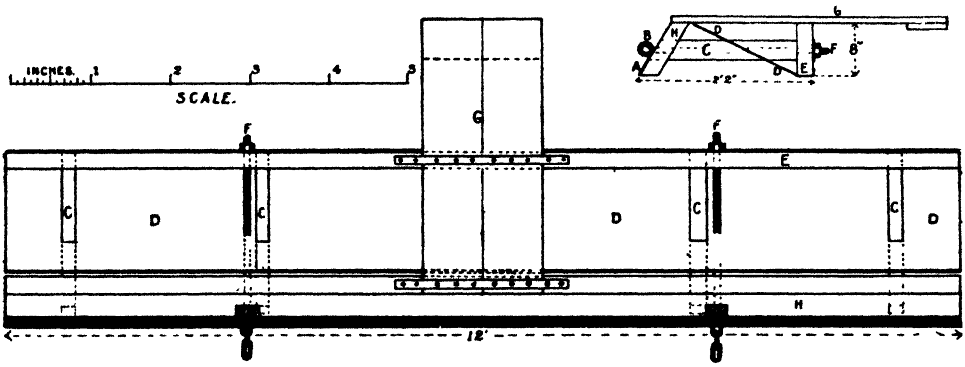
The buckscraper is simple in construction, and could be put together by any man handy with tools; the ironwork could be made by any blacksmith.

It will be found invaluable on the farm for grading, levelling, or any work where there is earth to be removed a short distance, and it can be done much more cheaply and efficiently by this means than with a tip-dray and shovel. There are times of the year when important farm work is slack, and when the farmer has often a number of horses idle. Such times as these could be profitably employed in improving those portions of land which are not naturally well drained, and where crops are often destroyed through water accumulating in hollows and depressions.

A LAND-SMOOTHER.

In cases where areas are being prepared for the purposes indicated in the foregoing notes, or are being made ready for crops under irrigation, a land-smoother will be found of considerable service.

Having prepared the land and obtained a fairly even surface by means of the buck-scraper described above, it will probably be necessary to use a smoother if the land is to be used for such a purpose as an



irrigated lucerne field. The sketch shows very clearly how such an implement is constructed. It is essentially a wooden frame, made of Oregon or other light strong timber, framed up as shown, the front piece (H) being set at an angle of about 60 degrees to the horizontal, and faced with iron to form a cutting edge, while from the lower edge of E to near the upper edge of H is fixed a sheet-iron plate, marked DD; this must be cut to allow the rails (CCCC), and the draught bolts (BF) to go through; on top is fixed a platform (G). On this the driver and sole operator stands, moving forwards or backwards as he requires to cause the cutting edge (A) to scrape away the soil, or the sloping sheet-iron (D) to "waste" it gradually over a depression The implement can be any length; from 8 feet to 12 feet will be found convenient, using two horses in the smaller size, and four in the other. If two are used, each horse is attached by a single swing to a draught chain about 4 feet long; and if four horses are used they should be coupled in pairs by double swings. A line should connect, the horses' heads being attached to the bits.—F. G. CHOMLEY.

Experiments with Potatoes.

GEO. MARKS,

Experimentalist, H. A. College.

THE land upon which the potato experiments this season were carried out, consists of a light red sandy loam. Two acres were planted, one being devoted to a trial of varieties, the other to a trial of various fertilisers. Favourable weather conditions prevailed at time of planting, the soil was in splendid mechanical condition, and everything pointed to a good harvest. With few exceptions, the whole of the varieties grew well during their early stages, but at the critical period, when the tubes were just commencing to form, dry weather set in, and continued more or less constantly till the crop was harvested. As will be seen from the return given below, the total amount of rain that fell while the crop occupied the ground was under 6 inches,—August 43 points, September 53, October 192, November 163, December 102; total 553. Thunderstorms gave us the bulk received during November and December, and each of the falls was invariably followed by drying winds, which speedily left the land in its former state. In December, hot westerly winds seriously affected the growth of the plants, the edges of the leaves and the young tender shoots being burnt off as if scalding water had been poured over them. Under such conditions, with the thermometer standing for days at 110 deg. F. in the shade, and taking into consideration also the poor nature of our soil, good results could hardly have been expected. Although the yields throughout are low, the results are very interesting, as they show to some extent the drought-resisting qualities of the varieties under trial. Although it would not be fair to condemn a variety solely on the results obtained this season, still we are safe in concluding from observations made for several seasons in succession, that some of the varieties are totally unprofitable for growing under our hot dry conditions, and on that account are now being discarded.

Variety Trials.

These were grown in Plot B 17. Field peas occupied the ground the previous Autumn, and produced a fair amount of vine, which was ploughed under as green manure in the early spring. The moist condition of the land promoted their speedy rotting, and when it was reploughed and worked down in August, the whole plot was left in a fine friable condition. Drills were struck out with a single furrow plough at a distance of 2 ft. 6 in. apart, and about 4 inches deep, and the sets were planted along these every 14 inches. The "sets" consisted of medium-sized whole, and cut tubers. The latter were dipped in lime to prevent excessive bleeding. All the varieties were planted on the 23rd August. Each drill was covered in with the hoe

as soon as planted to prevent the soil around the sets from becoming too dry. When all were covered, the whole plot was harrowed lightly. During growth the soil between the drills was kept clean and loose by frequent applications of the Planet Junior cultivators, drawn by mules, and at flowering time they were lightly hilled. The crop was harvested on January 3rd, and the following table gives the names of the varieties and their respective yields.

Name of Variety.	No. of Drill.	Weight of Drill 1 chain long.	Rate of yield per acre.			
		lb.	tons.	cwt.	qrs.	lb.
Early Rose	2 A	33	3	17	3	4
Adirondack	6 A	14	1	13	0	0
Carmen No. 1	7 A	18	2	2	1	20
Ruby	8 A	22	2	11	3	12
Avoca	11 B	26	3	1	1	4
Sutton's Centenary	12 B	12	1	8	1	4
Oxberry	13 A	14	1	13	0	0
Breeze's Peerless	13 B	16	1	17	2	24
Robin Adair	13 C	11	1	5	3	20
Sutton's Early Regent	14 A	13	1	10	2	16
Bliss Triumph	27 B	18	2	2	1	20
Reading's Giant	19 B	10	1	3	2	8
Breeze's Prolific	19 D	20	2	7	0	16
Imperator	21 A	34	4	0	0	16
Early Puritan	21 B	16	1	17	2	24
Centennial	22 B	18	2	2	1	20
Satisfaction	22 C	29	3	8	1	12
Anderson's A1	23 B	16	1	17	2	24
Red Russet	23 C	18	2	2	1	20
Irish Flounder	24 B	17	2	0	0	8
Australian Monarch	24 C	21	2	9	2	0
Cambridge Kidney	25 B	16	1	17	2	24
Snowdrop	26 B	10	1	3	2	8
Royalty	26 C	27	3	3	2	16

American Varieties.

In February, 1904, a consignment of ten varieties of potatoes, from Messrs. J. M. Thorburn and Co., was received through the Seed Branch from the United States. The bulk of them arrived in good condition, and were well sprouted. They were planted in March, but owing to the lateness of the season and unfavourable weather, none made more than half growth, and the first frost in May cut all the plants. In order not to lose the variety, what few tubers were formed were carefully harvested and set aside for spring planting. All of these were small, in fact with two varieties, the Green Mountains and the Aerial Rose, the tubers were no bigger than marbles, and the low yields obtained from these two as compared with the others aro doubtless largely attributable to this cause. Most of the tubers planted were uncut. It was not possible to plant a large area, but they were grown alongside our own sorts, and can therefore be compared with them. The following table gives the names and

yields of the varieties, the yield being estimated from a portion of a drill 1 chain long:—

Name.	Yield.	Rate of yield per acre.			
	lb.	tons.	cwt.	qrs.	lb.
Early Rose	33	3	17	3	4
Beauty of Hebron	34	4	0	0	16
Dakota Reds	13	1	10	2	16
Aerial Rose	11	1	5	3	20
Pride of the South	24	2	16	2	8
Aroostook Company's Prize	30	3	10	2	24
Bliss Triumph	22½	2	13	0	4
Early Northern	30	3	10	2	24
Green Mountains	11	1	5	3	20
Unnamed	28	3	6	0	0

From a glance at the foregoing table it will be noticed that five at least of the varieties yielded well, and there is little doubt that the others will give excellent results when properly acclimatised and grown under more favourable conditions. They are selections made from the best varieties grown in America, and are certainly very promising with us. One very noticeable feature is that most of them are white or pale yellow skinned, with faint traces of pink. Bliss's Triumph is the only red variety, and is very similar to our own.

There appears to be a prejudice against white potatoes of almost any kind in our markets, and one generally finds that the red or brown skinned varieties command the best prices. They have the name of being better keepers and cookers. Our experience has been, that whilst most of our own white or light-coloured potatoes do not keep quite so long as the Ruby and others of the red-skinned type, still they are good keepers, and cook just as well as the best of them. Further tests in this direction will be made, especially with those kinds which have proved themselves heavy croppers.

The following is a brief description of the different varieties:—

Early Rose.—Colour, very pale pink; elongated; eyes, medium depth; skin, rough.

Beauty of Hebron.—White, long, and flattened; firm; eyes, full; skin, rough; a good type.

Dakota Reds.—Round, and a little flattened at the sides; pale pink; eyes, deep; skin inclined to be smooth.

Aerial Rose.—Very pale yellow; elongated; eyes, full; skin, rough.

Pride of the South.—Round; pale yellow, with pink eyes; eyes, deep; smooth skin; a good potato.

Aroostook Company's Prize.—Pale yellow, flat, and elongated; eyes, few, but very full; skin, smooth.

Bliss' Triumph.—Round; red; deep eyes of a darker tint; skin, smooth; similar in most respects to our own type.

Early Northern.—Elongated; very pale yellow; eyes, full; skin, rough; a good potato.

Green Mountains.—Elongated; pale yellow; eyes, full; skin, smooth.

Unnamed variety.—Elongated; white; eyes, very full; skin, smooth; a good variety.

The Northern Star.

This potato, bred by Mr. A. Findlay, of Markinch, Scotland, is a new variety, which has the reputation of being a heavy cropper and disease-resisting. That it is the former has been borne out by Mr. Henry Bennett, of North-east Valley, Dunedin, New Zealand, who last year imported 7 lb. weight, and obtained 1,080 lb., which is at the rate of 30 tons to the acre.

Mr. Bennett very generously presented this College with a box of this celebrated potato, which arrived in splendid condition on the 19th August last year. A week later another parcel was received through the Seed Branch. Being well shot, they were at once planted in well prepared land, which consisted of a red loam, previously manured with a dressing of farmyard manure. The young plants had to be protected from a couple of late frosts by covering them with hessian. As in the other trial, dry weather set in at the time the tubers were forming, and completely arrested their growth. They were harvested on the 23rd December. Each plant had from eighteen to twenty-four tubers, all about equal size, but not more than half developed, and there is no doubt that if the weather had permitted them to fully mature there would have been a record yield. As it is, the yield was considerably above the rest, being at the rate of 6 tons 6 cwt. per acre. This, too, is a firm, white potato, round, with rough skin, and a little flattened. For comparison, it was grown alongside a number of others in short drills 20 feet long, each drill consisting of fifteen plants. The following are the results in lbs.:—Aerial Rose, 4¾; Green Mountains, 4¼; Carmen No. 1, 6½; Brownell's Beauty, 9½; Queen of the Valley, 2½; Hero, 4½; Sutton's Reading Russet, 7½; Red Skin Flourball, 9½; Breeze's Peerless, 9; Northern Star, 16¼; Early Northern, 15; Aroostook Company Prize, 15; Sutton's Early Regent, 10; Robin Adair, 8½; American Freeman, 10; Beauty of Hebron, 13½; Early Rose, 13; Avoca, 5½; Herd Laddie, 6¾; Up-to-Date, 13½; Lord Tennyson, 4½; Ruby, 13½; Bliss Triumph, 11; Dakota Reds, 13; Adirondack, 7¼; nameless from America, 11; nameless from Parramatta, 10. The latter variety was received from Mr. F. M. Stratham, orchardist, Ninda, Cumberland Heights, Parramatta, and came originally from Norfolk Island. It appears to be a good potato. From a glance at the above, it will be noticed that the Northern Star gave the heaviest yield, and two of the American, the Early Northern and Croostook Company Prize, come next. At present all the seed of this and the American varieties is required for present planting, but it is hoped that a quantity will be available for the Seed Branch to distribute next year.

Fertilizer Trial.

This experiment was carried out in Plot B 5. The soil is a light red loam, and was cropped the previous season with maize. This was cut down and ploughed under in May and allowed to rot. In August the land was reploughed and well worked. Drills were set out 2 feet 7 inches apart, and 4 inches deep. The plot was divided into two sections, A and B, and each of these was subdivided into ten, which were thus one-twentieth of an acre each. "A" section received a dressing of farmyard manure at the rate of 10 tons to the acre, while "B" section was untreated in this respect.

The object of the experiment was to test the effect of commercial fertilizers, with and without the addition of farmyard manure; also to specially note the effect of potash alone, and with the various mixtures. The chemical fertilizers were spread along the drills, and the tubers planted immediately afterwards. The variety selected for the trial was the well-known Brownell's Beauty. The chemical fertilizers were generously supplied by Mr. J. M. Hattrick, manager for Australasia of the Agricultural Offices of the Potash Syndicate. The potatoes were planted on the 26th August, and all grew well in their early stages. The trying weather conditions prevented the plants from getting the benefit of the manures, and the absence of any appreciable difference in the yields is doubtless due to this cause. At the same time, it shows that besides good soil, and constant cultivation, favourable weather is an essential factor in obtaining satisfactory returns, and unless there is sufficient moisture in the soil to render fertilizers soluble and available for the use of the plants, increased yields cannot be expected. The following tables show the results:—

"A" Section,—Farmyard Manure, with Chemical Fertilizers.

No. of Plot.	Kind of Manure.	Rate per Acre.	Yield (cwt. qrs. lb.)	Yield per Acre. (tns. cwt. qrs. lb.)
A 1	No Manure of any kind	.....	3 1 15	3 7 2 20
A 2	Farmyard Manure, 10 cwt. .. ... 11¼ lb. Superphosphate	10 tons .. 2 cwt. ...	3 1 14	3 7 2 6
A 3	Farmyard Manure, 10 cwt. .. ... 5⅝ lb. Sulph. Potash	10 tons ... 1 cwt. ...	3 2 0	3 10 0 0
A 4	Farmyard Manure, 10 cwt. ... .. 4¼ lb. Sulph. Ammonia	10 tons .. ¾ cwt. ..	3 2 0	3 10 0 0
A 5	Farmyard Manure, 10 cwt. ... .. 11¼ lb. Superphosphate .. ... 5⅝ lb. Sulph. Potash	10 tons ... 2 cwt. ... 1 ,, ...	3 1 19	3 8 1 16
A 6	Farmyard Manure, 10 cwt. ... .. 11¼ lb. Superphosphate ... ... 4¼ lb. Sulp. Ammonia	10 tons .. 2 cwt. ... ¾ ,, ...	3 2 0	3 10 0 0
A 7	Farmyard Manure, 10 cwt. .. .. 5⅝ lb. Sulph. Potash ... ... 4¼ lb. Sulph. Ammonia	10 tons .. 1 cwt. ... ¾ ,, ..	3 2 5	3 10 3 16
A 8	Farmyard Manure, 10 cwt. ... ... 11¼ lb. Superphosphate ... ... 5⅝ lb. Sulph. Potash ... ... 4¼ lb. Sulph. Ammonia	10 tons ... 2 cwt. ... 1 ,, ... ¾ ,, ...	3 2 21	3 13 3
A 9	Farmyard Manure, 10 cwt.	10 tons ...	3 1 5	3 5 3 16
A 10	No Manure	......	3 1 15	3 7 2 30

"B" SECTION.—With Chemical Fertilizers alone.

No. of Plot.	Kind of Manure.	Rate per Acre.	Yield.	Yield per Acre.
		cwt.	cwt. qrs. lb.	tns. cwt. qrs. lb
B 1	No Manure	.... ..	3 1 20	3 8 2 8
B 2	22½ lb. Superphosphate	4	3 2 6	3 11 0 8
B 3	11¼ lb. Sulph. Potash	2	3 2 8	3 11 1 20
B 4	5⅝ lb. Sulph. Ammonia	1	3 2 5	3 10 3 16
B 5	22½ lb. Superphosphate	4	3 0 14	3 2 2 0
	11¼ lb. Sulph. of Potash	2		
B 6	22½ lb. Superphosphate	4	3 0 14	3 2 2 0
	5⅝ lb. Sulph. of Ammonia	1		
B 7	11¼ lb. Sulph. of Potash	2	3 0 17	3 3 0 4
	5⅝ lb. Sulph. of Ammonia	1		
B 8	22½ lb. Superphosphate	4	3 1 17	3 10 2 4
	11¼ lb. Sulph. of Potash	2		
	5⅝ lb. Sulph. of Ammonia	1		
B 9	22½ lb. Superphosphate	4	3 2 0	3 10 0 0
	11¼ lb. Muriate of Potash	2		
	5⅝ lb. Sulph. of Ammonia	1		
B 10... ..	No Manure	......	3 0 0	3 0 0 0

HAWKESBURY DISTRICT FARM NOTES.

H. W. POTTS.

Maize.—In many parts of the uplands in this district the maize crops have proved a failure, owing to shortage of rain in December and the heat of January. This exceeded records of many years past. In many places, and including the College farm, the maize was cut and conserved as ensilage.

Sorghums.—The early sown varieties are in flower and have displayed a hardiness and vigour under extreme conditions of heat which serve to show what a valuable fodder we have in sorghums. The later crops have only been saved by constant shallow cultivation.

Lucerne.—We must be ever mindful of the great value of this rich and succulent fodder plant and the need for extending its cultivation. This month the ground can be prepared. Where new location is selected the potent factors in its successful growth are the soil and subsoil, particularly the latter. A deep penetrable subsoil, free from stagnant water and well drained, and in which the roots of the plant will search for moisture and plant food at great depths, are good conditions, even where the soil is not particularly rich. Loam soils, with a good percentage of sand, are always favourable to sturdy growth. A well-tilled soil and at a good depth, free from weeds and fairly moist, is needed to give the young plants a good start. In our warm climate it is advantageous that the seed-bed should be well fertilised with a leguminous crop ploughed in as green manure. Farm-yard manure is also an excellent stimulant to growth, but it possesses the power to introduce troublesome weeds. The surface must be very fine to give the young plant a vigorous start. From 15 to 20 lb. of clean seed may be sown broadcast per acre. It is of the utmost importance to purchase the seed healthy and free from dodder. So long as there is

sufficient moisture the prevailing high temperatures will be in its favour. Where the soil is deficient in lime this can be rectified by a dressing of superphosphate. Sowing operations may be taken in hand towards the end of this month with safety. Heavy crops of fodder naturally depend on well selected soil of good depth, thoroughly drained, heavily manured, and in clean condition.

Rape.—Many farmers will recollect the great benefits derived from the growth of that succulent, quickly-growing plant, rape, immediately after the big drought in 1902. We have had conditions this season, through the excessive heat wave and absence of rain, which recall that trying period. We need green feed early this winter to replace the summer crops which failed. Rape furnishes an excellent food for horses, cattle, sheep, pigs, and poultry. Its feeding value has been demonstrated to be greater than clover. All domestic animals relish it. The objections raised to it by dairymen as a taint producer is readily overcome, and its known properties as a milk producer render it worthy of attention. As a fodder for sheep in the production of mutton it is one of our best foods. It is equally valuable as a pork feed. For poultry few green foods are so well relished and provide such an abundance of suitable feed for egg production. Where the season is likely to be a moist one, our experience points to the broad-casted crops working better and more rapid growth than a drilled one. There is a continued increase in weight until the crop is mature. Where two cuttings are required it is best to cut the first crop midway between planting and flowering—*i.e.*, about twelve weeks from planting. Where drilling is adopted, which is indicated during moderately dry weasher, drills 2 feet apart produces the largest weight per acre. We have had as high as 11 tons of succulent green feed per acre less than seven weeks after sowing. In most instances, however, a full feeding crop may be reckoned on in twelve to fourteen weeks, and as high as 20 tons to the acre has been cropped. The best variety to sow is the broad-leaf Dwarf Essex, 4½ to 5 lb. per acre, either by hand or the wheelbarrow broad-cast seeder; and, where drilled, the Farmer's Friend maize drill, fitted with turnip plate. Rape will grow best in moist loam soils, where there is a preponderance of sand. Black soils, rich in humus, provide luxuriant growth, and it responds worst in stiff clay lands. It is best to avoid poor soils. Where they are light they may be fertilised by farm-yard manure or the following mixture :—

Nitrate of soda...	37	parts
Blood (dried)	33	„
Superphosphate	180	„
Sulphate of potash	60	„

about 2 cwt. to the acre, and lightly harrowed in. A firm, moist, fine seed-bed should be prepared on clean land, and well rolled after sowing. When the plant has obtained a good hold, then light harrowing may be done with care. Apart from its feeding value, rape fills a most important function in restoring fertility to the soil after an exhausting crop, such as maize, as a green manure. With

the aid of fertilisers catch crops can be grown so readily now-a-days, and none responds more freely and more profitably than rape. Its root system brings up phosphoric acid and potash from the subsoil. It penetrates and opens up the subsoil; provides rich, succulent foliage, which when fed-off provides manure, through the animal; enriches the soil, and when all is ploughed in leaves the ground in a fertile condition for cereals.

Macaroni Wheats.—These have been successfully used along the coastal areas for green fodder when sown early. From 6 to 10 tons per acre have been taken off as spring feed. One advantage this class of wheat possesses is that when cut green and top-dressed immediately afterwards with 1 cwt. superphosphates per acre and well harrowed it will produce a second crop for grain. This wheat yields good hay, provided it is cut before the beard becomes harsh and hard. Blount's Lambrigg, Medeah, and Belatourka have yielded from 2 to 3½ tons per acre. Seeing these varieties do not stool freely, it is best to sow thickly.

Oats.—The oat plant is harder to accommodate itself to harsh conditions and to poor soils. It does not exhibit such a tendency to fail under adverse cultivation and soils as will wheat or barley; in fact, it is not a fastidious crop. Naturally it prefers moisture and responds freely to good cultivation. The crop is readily affected by drought. For green feed the "potato" oat provides the richest and most palatable form of green fodder in this district. For early maturing qualifications the Algerian will rank first, and may be sown this month, even if the dry weather continues. Black and White Tartarion also provides a great weight of fodder and are useful sorts. Where good soil is available, with a fair depth, the skinless oats afford a splendid yield of succulent feed. It is best to sow 2 bushels of each sort to the acre, excepting the skinless; 1½ bushel of this sort will be enough. In making provision for feeding cattle in milk, it is good practice to combine oats with vetches or feas. Black vetches do well and may be sown ½ bushel to the acre with 1½ bushel of oats. The merit of the latter crop lies in the growth of a mixed fodder balanced with a nitrogenous food suited for milk; moreover, the legume has a renovating action on the soil, especially where the soil has been previously top-dressed with gypsum.

Barley.—May be sown this month, and will do best on well drained, light, open, warm soils. The skinless variety is a good green feed producer and provides the earliest crop. Sow 1½ bushel to the acre. Cape barley is deservedly a favourite here, and gives satisfactory yields of serviceable green fodder. Sown 1½ to 2 bushels to the acre gives good results, or this may be improved by the addition of ½ bushel of vetches to the acre. Where manure is required, use superphosphate, 2 cwt., with ½ cwt. nitrate and soda to the acre.

Rye.—It is generally realised that rye is a frugal plant, hardy and vigorous, and will thrive on soils where other cereals would practically starve. It can be grown continuously on the same class of land where gravel and sand predominate. Rye prefers a loose sandy loom. Although it gives a large yield of fodder, the hay does not possess

such a high food value as oats or barley; but seeing it does well on poor soils, withstands drought and low temperatures, we are often indebted to rye to give us cattle fodder when other more nutritious crops have failed. The variety known as Emerald is best liked, and may be sown this month, 1½ bushel to the acre. The food value may be improved by adding half bushel tares to each acre sown.

Cow-peas.—This season has been especially suitable to demonstrate the value of the cow-pea both as a fodder and green manure. Its noted characteristic is to grow freely in the hottest weather and with a minimum degree of moisture, and no better test could be afforded than the period covered by the extreme heat wave in the early part of January. The cow-peas grew well, and provided a green, succulent, tender annual, suitable for fodder. For sheep and pigs, during the height of summer, this fodder is especially acceptable; but where its chief value lies, in addition to feeding, is when ploughed in as green manure. It gives us a class of humus for absorbing and holding moisture, it supplies nitrogen, improves the texture of the soil, and provides a rapidly decaying mass of vegetation when the soil is warm, and it is readily converted into plant food.

Carrots and Parsnips.—Towards the close of the month these may be sown. The soil must be thoroughly well cultivated, rich to a good depth, to secure full growth of these deep-rooted plants. These roots are useful for horses, cattle, and pigs.

White Mustard is a rapid grower and gives useful crops of fodder to be fed-off before the plants are fully grown; a second and even a third crop may be taken off. The plant requires a warm, rich, light sandy loam. It can be sown broadcast or in drills, about 10 lb. per acre. It grows so quickly that it is often in bloom six weeks after sowing.

Hawkesbury Agricultural College.

MONTHLY WEATHER REPORT.

Summary for November, 1904.

Air Pressure.			Shade Temperature.				Air Moisture Saturation=100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 12 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for 7 years.	% of the year's Evaporation.
29·62 2nd.	30·28 8th.	30·004	42 7 5th.	95·4 21st.	70·[illegible]8	69·162	40 2nd.	82 21st.	60	·418 23rd.	6·496	5 323	14·574

Rainfall											
Date	2	10	12	14	15	16	17	27	29	Total,	Mean rainfall for 12 years.
Points	6	68	[illegible]	7½	trace	48	7	26	1	16[illegible]·8	213 points.

Wind	NE	SE	SW	W	NW
	18	·1	2	1	7

Thunderstorms on dates 1, 2, 10, 27, 28.

The month has been characterised by its dryness; mean temperature, amount of evaporation and wind have been above the average; rain below the average. Hail occurred, lightly, during one thunderstorm. The hot strong westerly of 2nd did considerable damage in burning leaf edges of tender plants. The rain that fell was quickly evaporated by the constant winds. Greatest daily range of temperature, 7th, 4[illegible]·6.

CHAS. T. MUSSON,
Observer.

SUMMARY for December, 1904.

Air pressure.			Shade Temperature.				Air Moisture Saturation = 100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 12 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for 7 years.	% of the year's Evaporation.
29·75 18th.	30·24 10th.	30·002	50·0	111 5 31st.	74·658	72·406	40	53	43	·318 29th.	in. 6·647	6·215	14·8

Rainfall	Dec.	9	12	15	16	17	18	19	21	Total,	Mean rainfall for 12 years,
		6	1	3	42½	35	4	½	6	0 980	2·603

	N	NE	E	SE	S	SW	W	NW
Wind ..	3	18	...	1	4	6	3	2

Thunderstorms on dates—12, 16, 17, 18, 19.

Greatest daily range of temperature, 51°·4, 30th.

Days on which shade temperature rose above 90° Fahr.—2, 6, 7, 8, 14, 15, 20, 21, 24, 25, 26, 27, 28, 29, 30, 31.

Remarks.—A dry month. Temperatures very high during the last week, the mean being 2° below that of December, 1896, and corresponding closely with that of December, 1899. Winds, in spite of some strong westerly's, were not excessive in strength.

CHAS. T. MUSSON,
Observer.

SUMMARY for January, 1905.

Air Pressure.			Shade Temperature.				Air Moisture Saturation = 100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 12 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for 7 years.	% of the year's Evaporation.
29 67 3rd.	30 29 7th.	30·009	47 4 24th	111·0 1st.	75·938	73 750	40	63	41	·376 22nd.	6·479	5·819	14·4

Rainfall ..	3	4	21	22	26	27	29	30	Total,	Mean rainfall for 12 years,
	8·8	5½	1	20	2	9	23	27	0·963	3·017

	N	NE	E	SE	S	SW	W	NW
Wind	1	25	...		3		1	..

Thunderstorms on dates—3, 4, 21, 29, 30.

Greatest daily range of temperature, 50°·5, on 2nd.

Days on which shade temperature rose above 90° Fahr.—1, 2, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 26, 29.

Remarks.—A dry month, every day save two giving the minimum air moisture content. With exception of a few days there was but little wind, and until the last two days no useful rain. Temperatures were exceptionally high during the early days, mean for the month reaching nearly 76, as against 78 for January, 1896, the hottest ever recorded here.

CHAS. T. MUSSON,
Observer.

YEARLY WEATHER REPORT.

SUMMARY for 1904.

	1905.	Highest, in 1902.	Lowest, in 1893.
Mean Yearly Temperature	62·025	63·120	61·87

	in.
Evaporation from a water surface for year	46·189
Highest in a month, December ...	6·647
Lowest ,, ,, July ...	1·294
Rainfall. Total for year	23·946
Highest recorded in Richmond, 1892 ...	50·242
Lowest ,, ,, 1902 ...	19·151

College records commenced January, 1893.

Rainfall records for Richmond, 1892, and back to 1881, taken by Mr. T. H. F. Griffin, during that time living there.

A dry year, with exception of July, which gave over 11 inches of rain, the only good falls occurred in April.

CHAS. T. MUSSON,
Observer.

Orchard Notes.

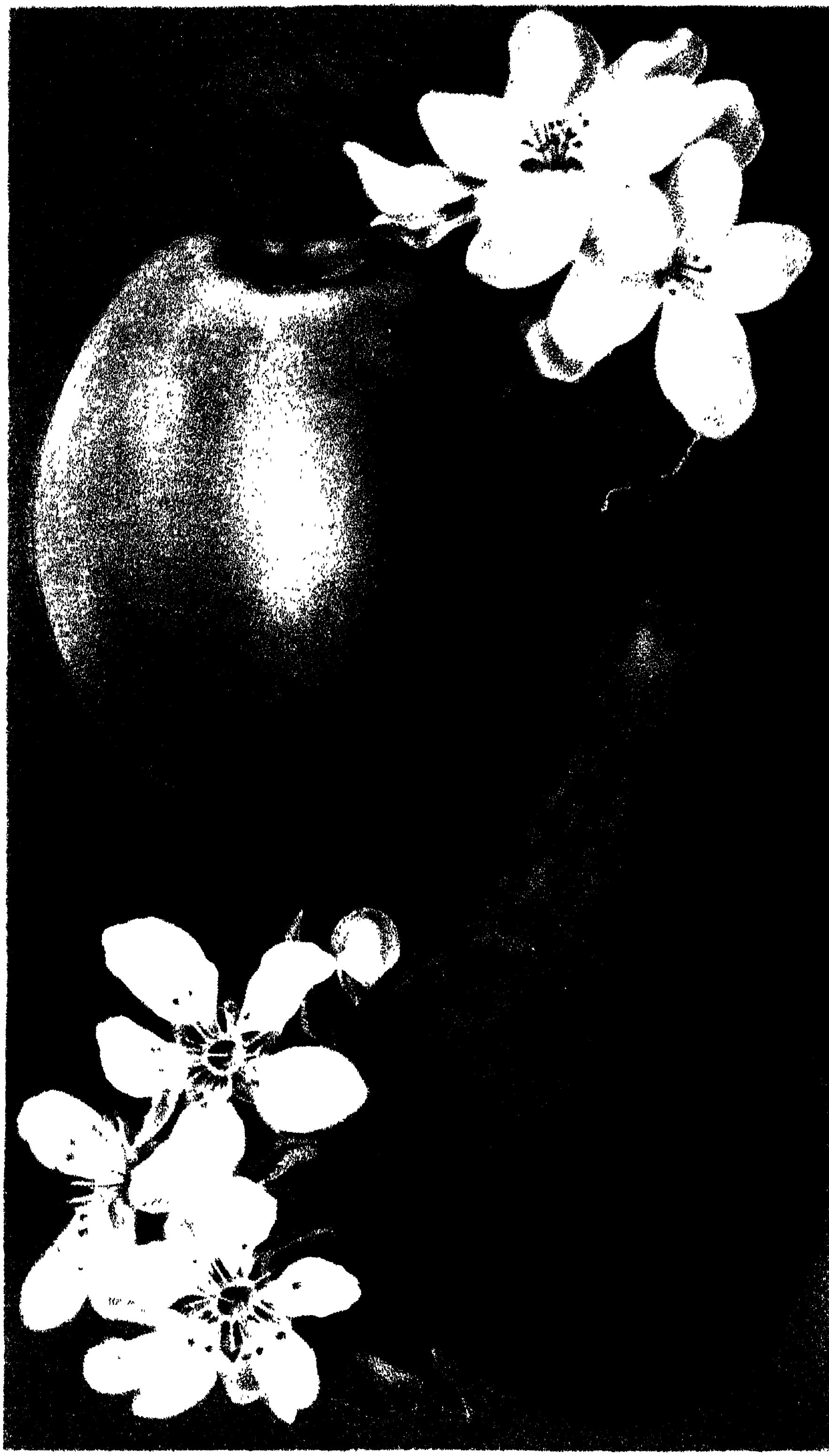
W. J. ALLEN.

MARCH, 1905.

THE orchardist or farmer who intends planting a new orchard, or extending those already established, should see that the land is prepared for the reception of the trees as soon as possible, as it is as well to have the land well broken up so that it may be exposed to the air and weather for some time prior to planting. The application of a ton of lime to the acre would materially improve its condition, particularly on sour country, and the grower would find himself well recouped for the outlay by the extra growth which the trees would make. This is the best month in which to sow peas or tares in the orchard, and to those whose soil is poor and lacking in humus, I would recommend giving a fair trial to this method of improving its condition. If the soil is poor it will be best to sow some of the many varieties of commercial fertilizers with the seed so as to give the latter a good start, when, with the aid of sufficient moisture from above, I feel sure that satisfactory results will be obtained. It may take two or three years to bring old worn-out soil into condition again; but if a person hopes to make a living out of the soil it is only by feeding it and keeping it in good order that he will have any chance of being at all successful.

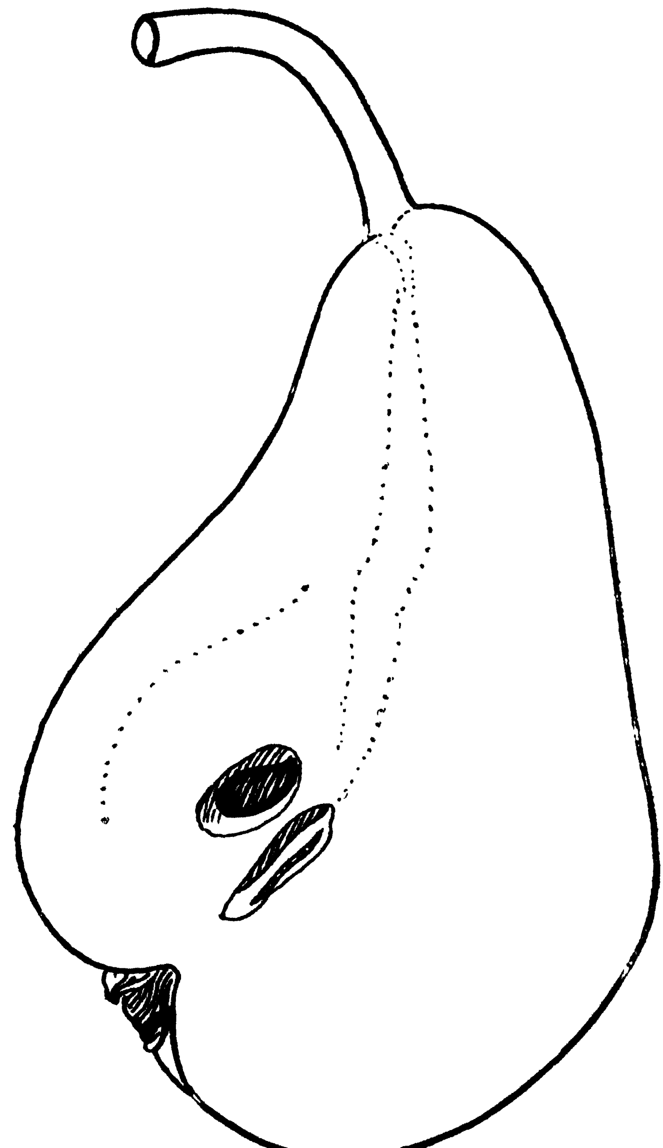
The winter months is the only time we can expect to have sufficient moisture in the orchard to keep both trees and crop growing, as in summer it requires all the moisture which we have been able to conserve to enable the trees to develop their fruit properly; therefore, if growers intend sowing either peas or tares they will have to see to it that same are put in early, so that they will have made a good growth by the early spring, when they will have to be turned under. An article on the subject of green manuring appears in the January number of this *Gazette*. Although it is rather late, some varieties of nursery stock can still be budded.

The drying of apples, raisin grapes, and prunes will—where these fruits are being grown—occupy the attention of the orchardist. After the apples are peeled and sliced they should be immersed for five minutes in a brine made as follows: Dissolve 1 ounce of salt, and dilute with 2 quarts of water, then spread the fruit on trays, and place in the sun or evaporator to dry. The Prune and Gordo Blanco grapes are, when ripe, immersed in a lye made as follows: Dissolve, by boiling, 1 pound of caustic soda in from 8 to 10 gallons of water,



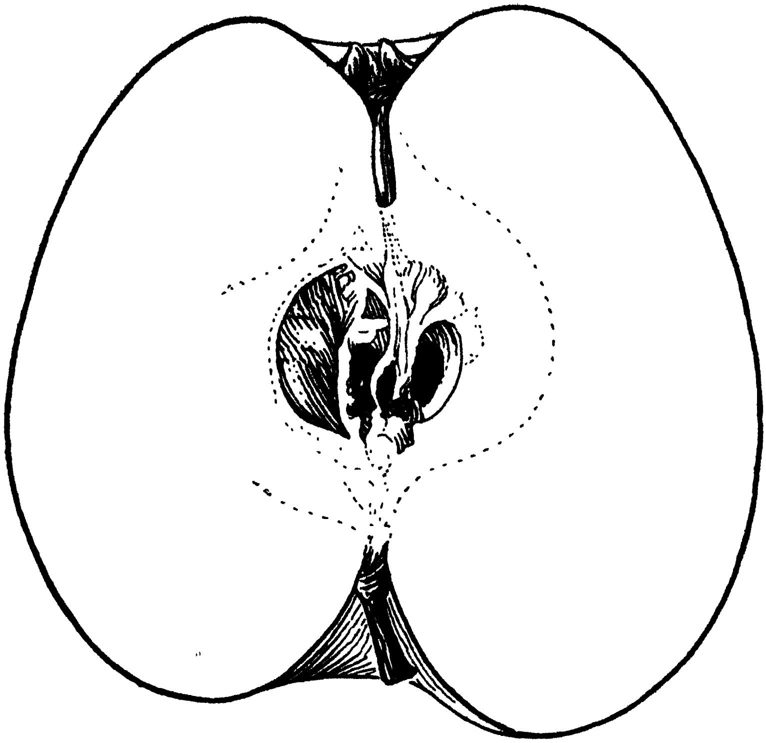
CLEOPATRA APPLE   BEURRÉ BOSC PEAR

and in this dip the fruit for about one or two seconds, or just long enough to make minute cracks in the skins when the solution is just on the boil. In some districts the skins will be found tougher than in others, and, therefore, it will be necessary to test the fruit to find out for what length of time it will need to be immersed in order to slightly crack the skins. Over dipping must be avoided, else the fruit when dried will be ragged, and, in consequence, would be classed as inferior. Before packing prunes they should be dipped in boiling water for at least five minutes; then put out in the sun to dry thoroughly before packing in boxes. In picking apples intended for keeping, see that they are fully ripe and coloured. Pick them carefully so as to avoid bruising; then pack in boxes lined with paper, and store them in the coolest place available. Never pick or pack the fruit when it is hot; the cooler it is when handled and stored the longer it will keep. Apples keep best in cold storage at a temperature of 32 degrees Fahrenheit. Where citrus fruits are found to be dirty it is not yet too late to spray the trees.



Section of Beurré Bosc Pear.

(See coloured Plate.)

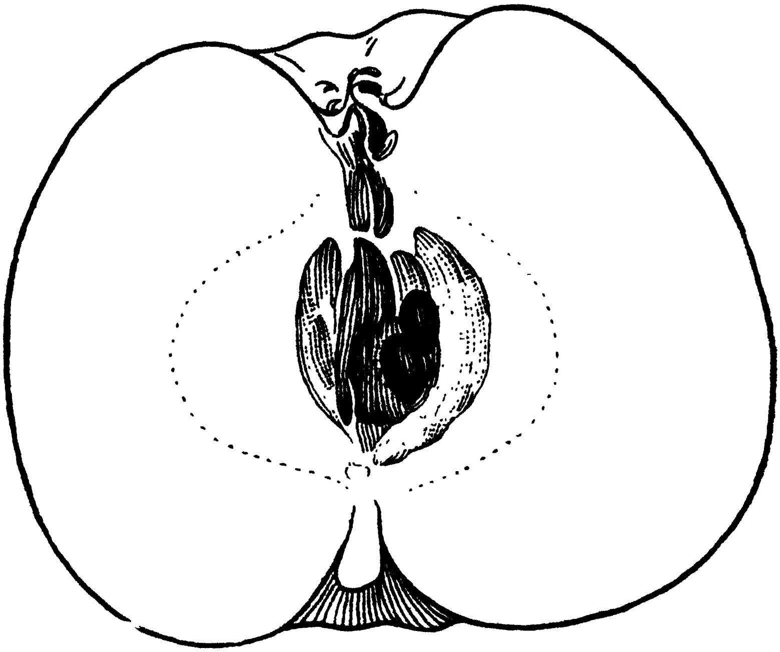


Section of New York Pippin or Cleopatra Apple.
(See coloured Plate.)

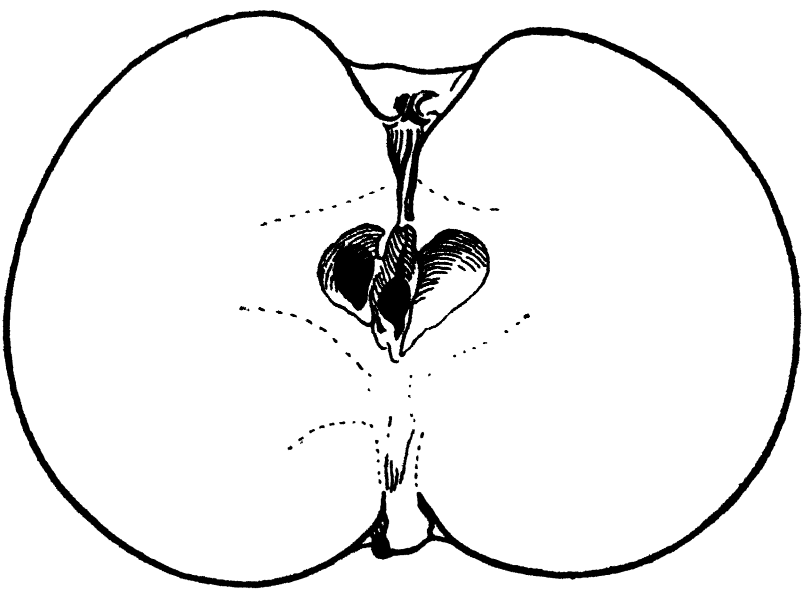
EXPLANATION OF COLOURED PLATE.

Beurré Bosc Pear.—This is one of our good dessert pears, and is found doing well in most of our cool districts, where it has proved a very profitable variety to grow. The tree is of rather spreading habit, and bears its fruit singly, and not in clusters, and, while hanging on the tree, looks as though it had been thinned. It was said to have been raised by Dr. Van Mons in 1807, and named after Calebasse Bosc in honour of M. Bosc, a celebrated Belgian cultivator. Fruit medium to large to pyriform, a little uneven, often tapering long and gradually into the stalk ; skin fairly smooth, dark yellow, mostly covered with streaks and dots of cinnamon russet, and occasionally slightly touched with red on one side ; stalk 1 to 2 inches long, curved ; calyx short set in a shallow basin ; flesh white, melting, buttery, with a rich, delicious, and slightly-perfumed flavour ; one of our best dessert pears, ripening about the latter part of April.

Cleopatra or New York Pippin Apple.—In Tasmania this apple is grown under the name of the New York Pippin, under which name it is exported ; and it was decided at the Fruit-growers' Conference, held in Hobart last April, that, as it was so favourably known, and had established a reputation under this name, it would be well to adhere to it for export purposes. It is one of the best apples we have growing at our Bathurst orchard, carrying heavy crops of good fruit, but very subject to bitter pit ; but by pruning the tree well, and keeping it quite open, and also spraying with Bordeaux mixture, we have reduced this disease so much that our loss from same is very small, and, notwithstanding this, it is one of the most profitable varieties we grow there. It is of American origin, and is known there under many names. The tree is of upright growth, and bears heavy crops of good even-sized fruit, which hangs in clusters, and is oblong, conic, sometimes obvate ; skin thin, lemon-yellow when fully ripe, with occasional blush in the sun ; eye small and closed, set in a small but rather deep basin ; stalk moderately long and woolly ; seeds small, set in large open cells ; flesh white, subacid, juicy, and aromatic, of good flavour ; good dessert and culinary ; ripens evenly ; will not hang on tree after ripe ; good keeper ; poor dryer ; one of the most profitable apples to grow were it not for its susceptibility to bitter pit ; blooms early in October ; ripens early in March.



Gravenstein Apple.



Annie Elizabeth Apple.

COLOURED PLATE APPEARED IN FEBRUARY ISSUE.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of March.

Vegetables.

At the time of writing these directions a general rain seems possible, as light showers have set in over a considerable portion of the State. At the present time rain is greatly needed, and vegetables are scarce; but, with some good soaking showers, which we may reasonably expect from this time forth, it should soon be possible to obtain all the vegetables required. The warm weather is likely to continue for some time in March, and then the temperature will become milder until autumn, and then winter sets in. Advantage of fine weather should be taken to prepare for sowing and planting; as soon as rain falls in sufficient quantity put the ground in good order, for, although it may seem uphill work to dig and manure whilst the soil is dust dry and, perhaps, hard and very disagreeable to get into order, still the advantages of being quite ready, in good time, are great. Any old vegetables should be removed to the manure heap, unless they are in any way diseased, or if the fruits on any of them were diseased—such as black spot on tomatoes—in which case they should be burnt, and the sooner the better. Towards the end of the month the weather will probably become comparatively cool, and those who desire to plant asparagus, rhubarb, herbs, globe artichoke, and strawberries (for the latter are generally grown in the vegetable garden) can start to work to put the ground in good order for them, using abundance of good farmyard manure if the soil is not naturally in first-class condition.

Asparagus.—This vegetable need give but little trouble after the ground is well prepared and the plants have been set out. For family use it will be best to grow the asparagus in a single row; indeed, this would be the best plan to adopt for all vegetables wherever space can be arranged, and it will save a good deal of dodging about, in cleaning up, in watering, when necessary, and in gathering the crop.

Beans, French or Kidney.—In all districts which are not likely to be visited by early frosts, these beans may be sown with every prospect of success, should the weather prove sufficiently moist, for, without a good deal of moisture, the beans are not likely to succeed. The dwarf kinds are most likely to succeed best during the autumn months. Sow the seed quite thin in the rows in order to give the plants a chance of growing well without being cramped. Seed will be saved, and the yield on same space of ground should be greater than if the plants are so close together as to deprive one another of moisture as well as of food.

Broad Beans.—A few seeds should be sown towards the end of the month, chiefly in the cool parts of the State, where these beans should grow well. Make use of ground where cabbages, or any other vegetable as unlike a bean or pea as possible has been growing.

Beet, red.—Sow two or three times during the month a few seeds to keep a sufficient supply of this vegetable in stock. It is a good vegetable, but, as a rule, is not grown nearly so extensively as is desirable. As beet is a native of the sea-side, its growth can be improved by the addition of a little coarse salt or of sea-weed whereever this can be procured easily.

Beet, silver.—Sow a few seeds in seed-bed just sufficient to raise enough young plants to replace any that are exhausted or are worn out. Transplant when seedlings are large enough into heavily manured soil, in order to enable the plants to produce large leaves with tender succulent midribs, for the midrib is the portion used. By pulling only a leaf or two from each plant at a time, a few plants should produce a good supply of leaves for a considerable period.

Borecole or Kale.—Sow in seed-bed a little seed and transplant like the cabbage as soon as the young kales are large enough to shift. Make the soil rich and allow each plant a good deal of space, say 3 feet apart each way. This is a useful vegetable for cold districts, for it will thrive well under severe frosts, and a few plants will yield an excellent return.

Broccoli, Brussels Sprouts, Cabbage and Cauliflower.—As these plants belong to the same family, and their requirements are practically the same, they may be treated alike to a great extent. Seed of them all may be sown from time to time during the month, and when the seedlings are well enough grown to move, prick them out from 4 to 6 inches apart, and when they have become strong, well developed plants, shift them to ground which in the meantime has been made ready. Move the plants with care and destroying as few roots as possible. Should the soil be dry when you desire to plant, water the plants well before moving them and afterwards when they are planted out. Cauliflowers should never have a check if possible from time of moving seedlings to time they heart. Use abundance of manure—that is farmyard manure, and if necessary apply liquid manure sometimes to keep them going.

Celery.—Sow a little seed, and try one of the self-blanching varieties. Advanced seedlings may be planted out in shallow trenches. Use abundance of manure, and if the weather is dry apply plenty of water and liquid manure.

Cress and Mustard.—Sow a little seed if this vegetable is required. Water the plants well should the weather be dry.

Endine, which is very much like lettuce, will be found a useful salad vegetable by those who have not grown or used it. Sow a little seed in seed-bed, and transplant when the seedlings are large enough to handle. Use a good deal of manure, and encourage the plants to grow quickly.

Herbs.—Seeds of all sorts of herbs may be sown now. The seed may be sown in pots or boxes, or anything convenient, and the young plants, after they are large enough to handle, can be set out where they are to grow.

Lettuce.—Sow in seed-bed occasionally a little seed, and transplant the seedlings as required. Any good strong seedlings on hand should be planted in well manured or rich soil. The lettuce, like the endine, should be encouraged to grow speedily, so that when large enough for use it should be tender and crisp.

Leek.—March is a good time of year for sowing seed of this vegetable extensively, although there is no necessity to grow too much of any single vegetable. Far better to have a good variety and frequent changes. Any young leeks on hand may be planted out. Make the soil as rich as possible, and plant in shallow tronches. The leek needs a good deal of moisture during its growth, and should the weather and soil be dry use abundance of water.

Peas.—In cool climates sow a row or two of peas.

Radish.—Sow a little seed to keep up a supply if required.

Sea Kale.—A little seed may be sown in seed-bed.

Spinach.—Sow in drills, about 18 inches apart, seed of this useful vegetable. The soil should be made rich with good manure if not naturally in good heart.

Shallots.—Obtain cloves or bulbs of these vegetables, and plant out firmly about 1 foot apart. The soil should be in good order, and well manured.

Garlic.—Plant in the same way as you would shallots, dividing the cloves before planting.

Flowers.

Anyone who desires to have a good show of spring flowering bulbs should plant extensively during the month. The best bulbs to plant are daffodils, tulips, hyacinths, sparaxis, ixias, babianas, ranunculuses, crocuses, anemones, snowdrops, watsonias, snowflakes, and for very cool climates snowdrops. Towards the end of the month plant out violets, daisies, polyanthuses, cowslips, and in quite cool districts auriculas, and also towards the end of the month sow seeds of hardy annuals, and also seeds of perennials. These seeds may be sown either in seed-beds, or in pots or boxes, for transplanting, or in the garden in places where they are to grow and flower. The sowing for transplanting will probably prove the most successful, for the seeds and young seedlings can best be looked after when seed-beds, boxes, or pots are used.

Hardy annuals raised early in the autumn should flower quite early in the spring and make the garden quite gay with all sorts of pretty flowers.

Cuttings of many kinds of plants should strike root well towards the end of the month, and the best time of year for putting in rose cuttings is also about the end of this month or during April.

General Notes.

Bots in Horses.

Bots in horses now being prevalent in some districts, several inquiries having been made for information, the following extracts from the report of the Government Veterinary Surgeon, Mr. J. D. Stewart, M.R.C.V.S., will be found to cover the whole question:—

"The parasites known as 'bots,' which infest the digestive organs of the horse, are larvæ of certain gad-flies.

"*Description of the Flies.*—So far as I am aware, there are but two species of bot-fly or horse-bee existing in this State. The more common one is technically known as the *Gastrophilus equi.* It is described by Neumann as being a woolly insect, covered with a white silky down, forehead fawn coloured, the posterior part having black hairs, antennæ rust coloured, thorax sometimes entirely covered with reddish hairs, and most frequently having a black transveral band. The abdomen is of a yellowish-brown tint, with irregular denticulated brownish-grey or dark spots. The wings are transparent, and have in their middle a transverse, smoky band, their posterior extremities having two spots of the same tint. The posterior portion of the male is obtuse, but the abdomen of the female is, on the contrary, extended as a large oviscarp, which is doubled up under that region when at rest. The length of the insect—not including the oviscarp of the female—is about half an inch.

"*Distribution.*—The species is found throughout Europe, Great Britain, Africa, Asia, North America, New Zealand, and of recent years in Victoria and New South Wales. With regard to its dissemination in this State, the pest was first reported to have appeared in the Bombala district; from there it gradually spread northward along the eastern side of the mountains, it being successively reported to be prevalent at Nowra, Braidwood, Moss Vale, Camden, Sydney, the Hunter River District, and lastly, during the past summer, in the North Coast District.

"*Life History.*—The fly exists in its perfect state in this country from September to March, during the warmest hours of the day the female flies buzzing about the horses. It hovers about for a few seconds over the place where it seeks to deposit its egg, drops an egg on it, and immediately flies away, but soon returns to lay a second egg, and repeats the operation so often that hundreds of eggs may be found on the same horse. The horses of some countries do not appear to be disturbed by the process. The eggs are usually deposited under the

jaws, on the neck, breast, shoulder, and forearms. They are yellowish-white in colour, and conical in shape, and about one-twentieth of an inch long. They are transversely striated, and adhere to the hair by the small end, in the same manner as the 'nits' of the louse, the wide end carrying the operculum remaining pendant. They hatch out in a few days, and the larvæ escape through operculum, while the empty shell remains clinging to the hair. The larvæ are vivacious, and begin to crawl on the skin, causing a slight itching, which impels the horse to lick and bite the part. In this way the larvæ gain the mouth, and from there pass with the food into the stomach, where they attach themselves by means of hooklets arranged about their mouth-pieces, and subsist on the inflammatory products secreted by the mucous membrane. The bots remain in the horse's stomach for about ten months, by which time they have reached their maturity. They then detach themselves voluntarily, and passing along with the alimentary matter become expelled with the fæces. As a rule, they are evacuated during the night or early in the morning. At first they are very lively, and bury themselves in the excrements or in the ground. They remain hidden from thirty to forty days, when the perfect insect or fly emerges. Copulation takes place, and the females in their turn deposit their ova on horses. The other species of bot-fly is known as the *Gastrophilus hæmorrhoidalis*. It is also known throughout Europe, Great Britain, and North America. This fly is distinguishable from the former by its darker colour and its transparent wings and the absence of spots on them. While its habits are analogous to the *G. equi*, the female prefers laying its eggs on the lips of the horses, the process giving rise to an irritating tickling, which causes the animal to rub its lips against the ground, or on its fore limbs, and often the horse gallops away to evade the attacks of the insect. The eggs are darker in colour, while the larvæ are deeper red and somewhat smaller, and usually inhabit the rectum, where, as they mature, they assume a greenish tint.

"*Habitat of the Larvæ.*—The larvæ of the *Gastrophilus* inhabit horses which frequent pastures or live in the open air, and which do not receive much grooming. Occasionally, those of the *G. hæmorrhoidalis* cling to and mature on the soft palate, the pharynx (back of throat), and epiglottis (the top of the windpipe), and thereby cause interference with respiration which sometimes gives rise to grave conditions that terminate in asphyxia. It is mainly in the stomach that the larvæ of the *G. equi* are found, clings in bunches to the cuticlar portion of that organ. In number they vary from a few to hundreds. Occasionally the larvæ of the *G. hæmorrhoidalis* are found inhabiting the glandular portion of the stomach and the duodenum (the beginning of the intestines), but their common position is in the rectum.

"*Effects produced by the Larvæ.*—At the point where a larva attaches itself it produces a small circular sore or depression in the mucous membrane, around which is a circumscribed inflammatory area. As regards the ill effects the larvæ may have on the health of their host, many divergent opinions exist. Certain authorities have

attributed most serious consequences to them; but when we reflect on the extreme frequency of the gastric larvæ, the multitude of horses infested with them, and their frequently being present in enormous numbers in the stomach without even being suspected during life, owing to the absence of any apparent disturbance, we might be led to believe that they are altogether inoffensive. Still, one cannot examine the numerous sores they produced on the inner lining of the stomach without admitting that the functions of that organ must have been interfered with by the excessive irritation that had been going on. Interference with the function of the stomach produces indigestion, which often leads to colic of a fatal kind. Affected horses commonly have a hide-bound, emaciated appearance, notwithstanding the fact that they possess capricious, though irregular, appetites. When the larvæ inhabit the glandular portion of the stomach and the duodenum, they may give rise to inflammation, and cause perforation, which leads to peritonitis and death. Owing to the irritation of larvæ in the rectum, the animal often makes violent efforts at defecation.

"*Preventive Measures.*—The best prophylaxis is the prevention of the fly reaching the horse. In some countries the horses are hooded and rugged with light clothing, or are provided with fly-nets and tassels, which play over the parts usually attacked. As a substitute for clothing various applications have been tried, but unfortunately they do not retain their power for long. These applications commonly contain, oil, kerosene, creosote, tar, &c. The following formula is recommended:—Oil of creosote, 1 part; rape oil, 10 parts. With horses that are handled daily, the eggs can be removed by grooming, or destroyed by washing the parts where they are deposited with solutions of any of the carbolic sheep-dipping fluids, 1 part in 20 of water. As far as I am aware, no particular bird has developed an epicurean appetite for the bot-fly.

"*Treatment.*—With reference to medicinal treatment for the expulsion of the larvæ from the stomach, a great number and variety of drugs have been tried without satisfactory results. In endeavouring to remove the larvæ, acute inflammation of the stomach has been produced without causing them to relax their attachment. This is mainly on account of the manner in which they bury their heads, and owing to their tough skin. In some parts of England affected horses are drenched after a period of starvation with defibrinated sheep's blood, with the object of causing the bots to relax their hold by overgorging themselves, before administering medicines. Iron filings and ground glass have been given in the form of a ball some hours before drenching, the idea being to wound the bots and make them more susceptible to the action of the drugs. The most common and safest remedy is 1 to 2 oz. of turpentine mixed with the white of an egg, and given in a pint of raw linseed oil on an empty stomach. Though not wholly efficacious, its administration is often followed by the expulsion of a number of bots. When the larvæ are located in the rectum they may be removed surgically."

Analyses of Imported Messina and New South Wales grown Lemons.

The following analyses of Messina and locally-grown Lemons were made by Mr. F. B. Guthrie, at the Agricultural Department's Laboratory, at Mr. Allen's request:—

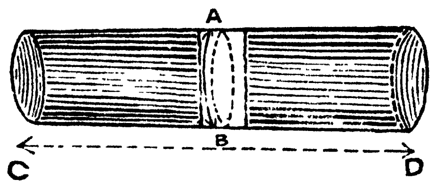
No.	Description of Lemons.	Total Weight of Five Lemons, in grams.	Total Weight of Juice from Five Lemons, in grams.	Total Weight of Pulp and Pips from Five Lemons, in grams.	Total Weight of Skin from Five Lemons, in grams.	Average Weight of One Lemon, in ounces.	Average Weight of Juice from One Lemon, in ounces.	Average Weight of Pulp and Pips from One Lemon, in ounces.	Average Weight of Skin from One Lemon, in ounces.	Juice obtained, expressed in per cent. of Weight of Lemons.	Pulp and Pips obtained, expressed in per cent. of Weight of Lemons.	Skin obtained, expressed in per cent. of Weight of Lemons.	Analysis of Lemon-juice obtained. Specific Gravity of Juice.	In grams per 100 of Juice. Free Acid as Crystalised Citric Acid.	In grams per 100 of Juice. Combined Organic Acids as Crystalised Citric Acid.	Ounces per Gallon. Free Acid as Crystalised Citric Acid.	Ounces per Gallon. Combined Organic Acids as Crystalised Citric Acid.
1	Messina	414	158	114·3	141·7	2·92	1·11	·81	1·00	38·2	27·6	34·2	1·0402	6·755	·265	10·81	·42
2	Cured Main Crop	585	211	202·5	171·5	4·13	1·49	1·43	1·21	36·1	34·6	29·3	1·0445	8·271	·112	13·23	·18
3	Cured Second Crop ..	630	282	236·4	111·6	4·44	1·99	1·67	·78	44·8	37·5	17·7	1·0389	6·665	·142	10·66	·23
4	Main Crop, fresh cut ..	645	169	150·9	325·1	4·55	1·19	1·07	2·29	26·2	23·4	50·4	1·0381	7·266	·331	11·63	·53
5	Messina, duplicate sample	464	184	139·0	140·0	4·08	1·62	1·23	1·23	39·8	30·0	30·2	1·0407	6·818	·200	10·91	·32

MEASURING TIMBER.

THE following formulæ for the measurement of timber in the rough are furnished from the code of instructions to Forresters.

The following formulæ should be followed in measuring timber:—

Formula for measurement of Logs.—Take the mean girth of a log in inches, divide by 4, and square it; multiply this result by the length of the log in feet, divide the whole by 12, and the result will be the contents of the log in superficial feet.



Example:

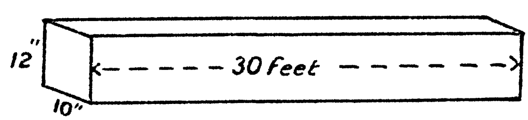
Mean girth AB=80 inches.

Length of log CD=30 feet.

$$\frac{\left(\frac{80}{4}\right)^2 \times 30}{12}=1{,}000=\text{contents of log in superficial feet.}$$

When a log is unsound or pipy, the square of the diameter of the unsound portion in inches, multiplied by the lengh in feet, and divided by 12, should be deducted from the full contents of the log.

Formula for measurement of Girders.—Multiply the end dimensions of the girder in inches one with the other, and again multiply the result by the length of the girder in feet, divide the whole by 144, and the result will be the contents of the girder in cubic feet.



$$\text{Example, } \frac{12'' \times 10'' \times 30}{144}=\frac{300}{12}=25 \text{ cubic feet.}$$

Formula for calculating proportionate rates for Split Timber, Props, Slabs, Fencing Timber, &c.—Multiply continuously together, the length of the piece of timber in feet, the width in inches, the thickness in inches, and the superficial rate for the class of timber in pence, divide by 12, and the result will be the royalty rate in pence per one hundred pieces.

Example.—Fencing posts (ordinary hardwood), length 7 ft.; width, 8 in.; thickness, 3 in. Rate per hundred superficial for ordinary hardwood, 5d.—

$$\frac{7 \times 8 \times 3 \times 5}{12}=70\text{d. per hundred pieces.}$$

The following simple rule for the measurement of sawn timber is also useful:—

Multiply the end dimensions in inches, divide by 12, and multiply by the length in feet.

Example—500 feet lineal of 3″ × 2″ sawn.

$$\frac{3 \times 2}{12}=\tfrac{1}{2} \times 500=250 \text{ super.}$$

Crown Lands of New South Wales.

The following areas will be available for selection on and after the dates mentioned:—

H.S. or S.L. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
			For Homestead Selection.					
			a. r. p.		a. r. p.		£ s. d.	1905.
960	Cooma ..	..	575 3 0	11	25 0 0 to 181 2 0	Cooma, 2 to 2½ ..	0 15 8 to 3 8 2	9 Mar.
961	Corowa .	Momalong.	465 0 0	6	65 0 0 to 80 0 0	Berrigan, 2 .	2 12 10 to 3 5 0	20 April
958	Grafton .	...	167 2 20	6	18 2 0 to 34 1 0	Maclean, 2 . .	0 4 8 to 0 8 8	6 ,,
959	Gunnedah ..	Trinkey .	...	1	1,270 0 0	Curlewis, 27	14 11 2	9 Mar
			For Settlement Lease					
								1905.
781	Coonabarabran.	Ulinda .	....	1	5,000 0 0	Coonabarabran, 30; Mudgee, 95, Binnaway, 1¼	93 15 0	6 April
780	Coonamble	....	5,030 0 0	2	2,440 0 0 and 2,590 0 0	Gilgandra, 10; Eringanerin, 3 & 4	35 11 8 and 40 9 6	16 Mar.
779	Deniliquin	Murgah .	6,599 2 0	1	6,599 2 0	Moulamein, 22 ..	116 17 4	9 ,,
782	Warren .	....	... .	1	2,575 1 0	Warren, 18	75 2 4	2 ,,

For Conditional Purchase.

Land District.	Name of Holding, &c.	Total Area.	Parish	County.	Price per Acre	Date available.
		a. r. p.			£ s d	1905.
Albury .. .	Woomargama .	40 0 0	Woomargama .	Goulburn .	1 5 0	20 April.
,, .. .	,, .	190 0 0	,,	,, ..	1 10 0	20 ,,
Bathurst ..	..	254 0 0	Langdale .	Westmoreland	0 6 8	9 Mar.
,, .	....	53 2 0	,,	..	0 10 0	9 ,,
,, .	....	313 0 0	,, . .	.. .	0 11 8	9 ,,
,, .	......	80 0 0	,, . .	,, .	0 13 4	9 ,,
Barmedman .	Mimosa	484 0 0	Trickett . .	Bourke .	1 0 0	30 ,,
Bega . .	.. .	240 0 0	Bredbendoura	Auckland ..	1 0 0	13 April.
Braidwood .	..... .	303 3 10	Bruce	St. Vincent	0 6 8	9 Mar.
,, .	. .. .	443 1 0	,, .	,, ..	0 13 4	9 ,,
Carcoar .	. ...	940 0 0	Wangalo and Burridgee	Georgiana .	1 0 0	13 April.
Casino .. .	... .	640 0 0	Nandabah ..	Richmond	1 5 0	6 ,,
Cootamundra .	. . ....	150 0 0	Yeo Yeo . ..	Bland ..	1 10 0	6 ,,
,, ..	. . .. ..	560 0 0	,, ...	,,	1 15 0	6 ,,
Eden . .	. .. ..	92,600 0 0	Pericoe Nungatta Genoa, &c.	Auckland .	0 10 0	9 Mar.
Gosford . .	....	45 0 0	Wyong .. .	Northumberland.	1 0 0	13 April.
Grafton	....	40 0 0	Toothill .. .	Fitzroy ..	1 0 0	13 ,,
Gunnedah .	..... .	1,203 1 0	Goragilla .. .	Pottinger .	1 10 0	9 Mar.
Inverell .. .	Long Reach .	1,280 0 0	Tienga	Hardinge .	1 0 0	13 April.
Lismore .. .	....	348 0 0	Byron ..	Rous	1 0 0	13 ,,

FOR CONDITIONAL PURCHASE—*continued.*

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		a. r. p.			£ s. d.	1905.
Lithgow ..	... .	290 0 0	Falnash ..	Cook .	0 18 4	30 Mar.
Moree . .	. ..	2,615 0 0	Wernna	Benarba .	1 0 0	13 April.
Parkes .	. ....	2,640 0 0	Gillenbine, Gobondery.	Cunningham & Kennedy	0 13 4	13 ,,
,, ...	....	1,040 0 0	Gillenbine	Cunningham	0 16 8	13 ,,
Scone . .	....	640 0 0	Oldcastle ..	Durham ..	1 5 0	6 ,,
Tenterfield	... ..	40 0 0	Wellington Vale .	Gough .	1 10 0	6 ,,
,,	Tooloon and Wood enbong.	400 0 0	Beaury .	Buller .	1 0 0	6 ,,
,,	Deepwater.. .	230 0 0	Angoperran	Clive	1 0 0	13 ,,
,,	. ...	1,370 0 0	Ruby .	Buller	1 0 0	13 ,,
,,	.. ..	184 1 0	Wellington Vale	Gough	1 0 0	13 ,,
,,	.. .. ..	1,280 0 0	Wunglebung	Clive .	1 0 0	20 ,,
Tumut ..	....	2,450 0 0	Cooleman	Buccleuch	0 8 4	6 ,,
Warren .	Haddon Rigg	4,000 0 0	Collemburrawang	Ewenmar .	1 6 8	20 ,,
Warialda .	....	430 0 0	Bullalla . ..	Burnett	1 0 0	30 Mar.
Wellington	. .	95 0 0	Curra .	Gordon	2 0 0	30 ..

CONDITIONAL PURCHASE AS SPECIAL AREA.

Forbes Land District, in parish Eugowra, county Ashburnham, 305¾ acres, in nine blocks ; maximum area, 87¾ acres, minimum, 12¼ acres ; price, £1 to £4 per acre ; distant 1 mile from Eugowra, about 21 miles from Cookamidgera and 25 miles from Forbes. Available 23rd March, 1905.

Gunnedah Land District, in parish Gunnedah, county Pottinger ; 51 acres in one portion ; maximum and minimum area, 51 acres ; distant 2 miles from Gunnedah ; price, £2 per acre. Available 13th April, 1905.

Murwillumbah Land District, in parishes Billinudgel and Mullumbimby, county Rous, 559 acres in four blocks ; maximum area, 320 acres, minimum, 40 acres ; distant 7 to 7½ miles from Mullumbimby ; price, £2 10s. per acre. Available 30th March, 1905.

Parkes Land District, in parish Currajong, county Ashburnham ; 22 acres 2 roods 20 perches in two blocks ; maximum area, 22 acres 2 roods 20 perches, minimum, 10 acres 1 rood ; distant 1¾ mile from Parkes ; price, £4 10s. and £5 per acre. Available 9th March, 1905.

Tamworth Land District, in parish Tamworth, county Inglis ; 2 acres in one block ; maximum and minimum area, 2 acres. Within the suburban boundaries of town of Tamworth ; price, £40 per acre. Available 23rd March, 1905.

(Signed) EDWARD MACFARLANE,
Under Secretary for Lands.

AGRICULTURAL SOCIETIES' SHOWS.

1905.

Society.	Secretary.	Date.
Lismore A. and T. Society	T. M. Hewitt	Mar. 1, 2
Liverpool Plains (Tamworth) P., A., and H. Association	J. R. Wood	,, 1, 2
Robertson A. and H. Society	R. J. Ferguson	,, 2, 3
Port Macquarie and Hastings District A. and H. Society	J. Y. Butler	,, 2, 3
Bombala Exhibition Society	W. G. Tweedie	,, 7, 8
Tenterfield Intercolonial A. and M. Society	F. W. Hoskin	,, 7, 8, 9
Fair Days	....	,, 10, 11
Barraba P., A., and H. Association	J. W. Bull	,, 8, 9, 10
Nepean District A., H., and I. Society	E. K. Waldron	,, 9, 10
Oberon A., H., and P. Association	W. Minehan	,, 9, 10
Berrima District Agricultural Show	Geo. Yeo	,, 9, 10, 11
Gulgong P. and A. Association	G. E. Hilton	,, 14, 15
Central New England (Glen Innes) P., A., and M. Society	Geo. A. Priest	,, 14, 15, 16
Campbelltown A., H., and I. Society	A. R. Payten	,, 14, 15, 16
Macleay A. and H. Association (Kempsey)	E. Weeks	,, 15, 16, 17
Newcastle and District A., H., and P. Association	M. A. Fraser	,, 16, 17, 18
Goulburn A., P., and H. Society	J. J. Roberts	,, 16, 17, 18
Cumnock P., A., and H. Association	W. L. Ross	,, 17
Blayney A. and P. Association	H. R. Woolley	,, 21, 22
Gundagai P. and A. Association	A. Elworthy	,, 21, 22
Warialda P. and A. Association	W. B. Geddes	,, 22, 23
Mudgee Agricultural Society	J. M. Cox	,, 21, 22, 23
Camden A., H., and I. Association	C. A. Thompson	,, 22, 23, 24
Crookwell A., P., and H. Society	C. T. Clifton	,, 23, 24
Wellington P., A., and H. Society	A. E. Rotton	,, 28, 29, 30
Namoi P., A., and H. Association (Narrabri)	J. McCutcheon	,, 28, 29, 30
Walcha P. and A. Association	S. Hargrave	,, 29, 30, 31
Hunter River A. and H. Association (West Maitland)	C. J. H. King	April 4, 5, 6, 7
Quirindi District P., A., and H. Association	Will. Cadell	,, 5, 6
Clarence P. and A. Society	Jas. C. Wilcox	,, 5, 6
Bathurst A., H., and P. Association	W. G. Thompson	,, 5, 6, 7
Upper Manning A. and H. Association (Wingham)	W. Dimond	,, 6, 7
Lower Clarence Agricultural Society (Maclean)	Geo. Davis	,, 11, 12
Orange A. and P. Association	W. Tanner	,, 12, 13, 14
Upper Hunter P. and A. Association (Muswellbrook)	Pierce Healy	,, 12, 13, 14
Cooma P. and A. Association	C. J. Walmsley	,, 12, 13
Richmond River (Casino) A., H., and P. Society	E. J. Robinson	,, 12, 13
Royal Agricultural Society of New South Wales	F. Webster	,, 19 to 27
Mudgee Agricultural Society	J. M. Cox	,, 21, 22, 23
Dungog A. and H. Association	Chas. E. Grant	May 3, 4
Moree P. and A. Society	S. L. Cohen	,, 10, 11
Hawkesbury District (Richmond) A. Association	C. S. Guest	,, 12, 13, 14
Walgett P. and A. Association	Thos. Clarke	,, 17, 18
Molong P. and A. Association	C. J. V. Leatham	,, 24
Hay P. and A. Association (Hay)	G. S. Camden	July 27, 28
Murrumbidgee P. and A. Association (Wagga Wagga)	A. F. D. White	Aug. 23, 24
Albury Annual Show	Walter J. Johnson	Sept. 12, 13, 14
Wyalong District P., A., H., and I. Association	S. G. Isaacs	,, 12, 13

[4 plates.]

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Agricultural Gazette of New South Wales.

The Tapeworms of Australia.

[Continued from p. 219.]

N. A. COBB.

Tapeworms of the Dog.

No other domestic animal is so subject to tapeworm as the dog. Every dog-owner may take it for granted that it is an even chance his dog is infested with one or more of the numerous species of tapeworms common in dogs all over the world. The reason for this remarkable prevalence of tapeworms in dogs is easy to understand, and the facts are instructive as well as interesting. The dog is naturally the subject of numerous parasites of this kind from the fact that he is carnivorous. He is the one carnivorous animal man has found it to his material advantage to domesticate, if we except one or two of the cat tribe, which, though they come in the same category, stand far behind the dog in importance. If we turn to any census of parasites we are at once struck, not only by the number but also by the variety of tapeworms that inhabit the carnivora, the cystic forms of these worms being, of course, found in the animals upon which the carnivora prey. Of the adult worms it seems that evolution has concentrated in the dog a larger number than is usual even in a carnivorous animal. Probably the explanation of this is the wide distribution of the wild form, or forms, from which the dog is derived, and, in a no less degree, that high grade of intelligence which has enabled it to bring under its sway an extraordinary range of herbivora as food. These facts are all in full harmony with the known variety and abundance of the tapeworms found in the dog. Now, it so happens that man has also domesticated a large number of the natural victims of the wild dog's rapacity, using them as food, beasts of burden, &c. These animals he often assembles in larger numbers than would ever have been found in a natural state. Then, to cap the climax, he turns them over to the care of his trained canine servant, to whom he donates as food those parts of their carcases which seem to him too unclean for human consumption—the very organs that serve as the bearers of the cystic forms which develop into tapeworms.

To take a concrete example, there is an extraordinary number of sheep in Australia, a land in which before the advent of the white man there were no sheep. The sheep is a natural prey to the wolf, and we may assume the same to have been true of the wild dog. The dog harbours a tapeworm, the *Taenia echinococcus*, which takes on its cystic form most frequently in the liver and lungs of the sheep. The Australian stock-owner unwittingly proceeds to actually breed this

tapeworm as follows:—He uses the dog in close conjunction with his sheep as a valuable aid in their control. Mutton naturally forms a staple food with him, and the liver and lungs, from which man instinctively turns as unclean, become the perquisites of the dog. Should these organs contain cysts the dog, of course, develops tapeworms, the eggs from which speedily become scattered where they can reinfest the sheep, and so the accumulation of tapeworm disease goes on. It is a great pity that this important fact is not better known and more widely appreciated. The obvious practical application of the fact would save a number of lives every year. I have taken as an illustration the particular dog-tapeworm that causes the hydatid of man, which is nothing but the appearance in man of the cysts spoken of above as occurring in the lungs and liver of the sheep. Comparatively simple precautions would prevent the occurrence of the hydatid disease that has become so notorious in this country.

About a dozen species of tapeworm are known to inhabit the intestine of the dog, this being a greater number than is known for any other animal. While the number of species is great for this animal, their frequency is also above the average, so that the proportion of infested dogs is very high indeed. In some localities about three-quarters of the dogs are infested with tapeworms. Fifty per cent. is a common proportion.

Of the numerous tapeworms known to infest the dog the writer has identified five in Australia, namely, *Dipylidium caninum*, *Taenia serrata*, *Taenia marginata*, *Taenia serialis*, and *Taenia echinococcus*. These various species will next be described from the Australian specimens.

4. *Dipylidium caninum* (*L.*).—This tapeworm, which has a very great resemblance to *Dipylidium ellipticum* of the cat, is very common in the dogs of this country. As in the *ellipticum*, the segments are joined together in the peculiar manner that reminds one strongly of a row of cucumber seeds placed end to end.

The total length is 100 to 400 mm. The specimen from which the present description is drawn had a length of 175 mm., being an average fully-developed specimen taken from a Sydney dog. The total number of segments is eighty-four, of which the neck segments measure ·3 mm.; the testicular, 1·5 x 1·7 mm. long; the ripe, 1·7 x 7·2 mm. long. From this it will be seen that the segments increase rapidly in length toward the posterior extremity, which also has the greatest width. The main features are well shown in the illustration. The margin of the anterior part of the worm is somewhat serrate, the cucumber-seed appearance being confined to the posterior half of the worm.

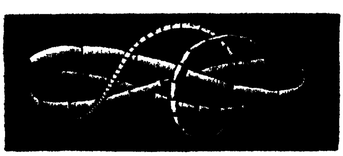


Fig. 17. Tapeworm of the Dog.
(Dipylidium caninum.)
Natural size.

The sexual pores are readily seen on either side of each of the segments of the posterior part of the worm, though this feature has been overlooked by the artist in the preparation of Fig. 17. These pores are located near the middle of the segment.

The somewhat quadrate head is twice as wide as the neck, and bears four circular suckers that face outwards. The well-developed and retractile rostellum carries four somewhat irregular rows of hooklets shaped like a rose-thorn. These hooklets are all alike, and are about 15μ in length. The rostellum of this worm is very mobile, being capable of an extension that renders it club-shaped, or an amount of retraction causing it to entirely disappear into the pouch in the midst of the suckers.

The eggs are borne in thin-walled capsules measuring 130–160 x 160–200μ. These capsules contain fifteen to sixty, or on the average about twenty, thin-shelled, spherical eggs, 40–44μ in diameter, each containing a well-developed embryo 32μ in diameter, and bearing six hooklets each about 10μ long. A ripe segment may contain about 400 capsules and some 9,000 eggs.

The known intermediate hosts of this worm are the two most common of the external parasites of the dog—namely, the flea and

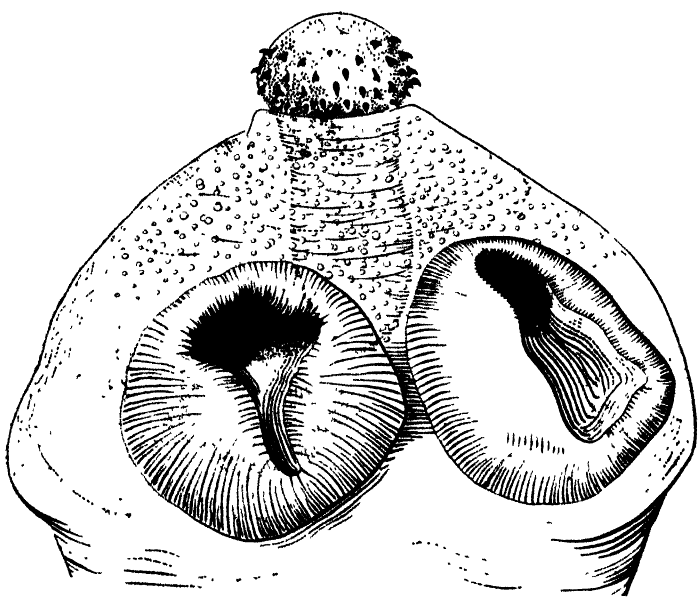


Fig. 18. Tapeworm of the Dog.
(Dipylidium caninum.)

Scolex or "head," side view. This is the head of the worm shown natural size in Fig. 17. The rostellum is shown in such a state of expansion that only the portion bearing the four irregular rows of hooklets is protruded. The rostellum can be protruded much farther than shown, and can be drawn completely inside the scolex. The transverse musculature of the rostellum is indicated in the sketch, and also the longitudinal retractor muscles, which are seen faintly near the posterior rows of hooklets. × 160.

the louse. As a rule, it is the flea that plays the part of intermediate host. How the flea becomes infested from the tapeworm eggs is a matter for speculation, but if infested fleas are fed to a dog he becomes a prey to the resulting tapeworms. This has been established by repeated experiment. The ripe proglottids of the tapeworm may occasionally be seen attached near the anus of infested dogs, and the eggs deposited by these segments are then to be found in large

numbers in the immediate vicinity, and less abundantly on the hair further away. In this situation the eggs are taken in by the louse feeding in its ordinary manner, as has been shown by experiment. As before remarked, it is not so certain in what manner the flea acquires the parasite from the eggs, but it may be surmised that the dog's kennel is a breeding-place for the fleas, and that here the larvæ of the fleas have a good opportunity to pick up the eggs of the tapeworm. The fleas pass readily from one dog to another, so that the tapeworm is spread with rapidity from dog to dog. The wide distribution of the tapeworm is thus accounted for.

Apart from its interest as one of the most frequent internal parasites of the dog, the *Dipylidium caninum* is of especial interest from the fact that it is hardly uncommon as a human parasite. It is found more particularly in young children, even quite young babies. The cases cited are, I believe, all European. As the only known intermediate hosts are the flea and louse of the dog, the only plausible assumption is that children infect themselves from these insects, or from an unknown host of similar character, *i.e.*, related species of insects infesting man himself. This adds a new terror to the flea and the louse.

Habitat.—Intestine of the dog, where it often occurs in large numbers.

5. *Taenia serrata*, Goeze.—I have seen a single Australian specimen of this parasite. It was removed from a Sydney dog. In spite of the vast numbers of the intermediate host (the rabbit, also the hare) to be found in this country, I doubt if this tapeworm is very common here. There is no record of its doing very serious injury to either of its hosts, so far as I know.

The specimen I have mentioned was only about 200 mm. long, whereas the length of full-grown specimens is 500 to 2,000 mm., the average length being 1,000 mm. It is certain that the specimen here described was young, for although the segments contained eggs to the number of some 50,000 each, many of these eggs were not yet completely developed—that is to say, the shells had not yet attained their full thickness. In looking over a large number of the eggs there was noticeable a considerable degree of irregularity in the colour and the thickness of the shells, those that were the thicker being the darker brown.

Measurements of segments in various parts of the body gave results as follows:—Neck, ·8 mm. wide; testicular segments, 5 x 2 mm. long; ripe, 5 x 4·5 mm. long. This is for a specimen 200 mm. long, and composed of over 200 segments. As the segments of *Taenia serrata* are said to become ripe at about the 175th segment, it will be seen that we have here a very complete accordance with the facts recorded by other observers. As a matter of fact, about twenty-five of the segments of the specimen from the Australian dog were producing eggs.

The margin of the worm is slightly crenate, the edges of the segments being only slightly curved. The colour is a brownish-white. The worm is thin and ribbon-like, the thickness being about ·8 mm. at the 200th segment.

The head is a little broader than the neck, more so than has usually been noted by other observers. The hooklets have the characters of those of *Taenia marginata,* but the smaller hooklets possess a more distinctly bifid anterior process for the attachment of the muscles. I neglected to measure or sketch these hooklets when the first examination was made, and they afterwards became lost.

The salient sexual pores are located a little behind the middle of the margin of the segment. Looked at from the face of the segment they appear decidedly two-lipped. They are irregularly alternate. From the pore, both the vagina and the cirrhus pouch pass inward at right angles to the margin of the segment. The pouch is narrow, but not so narrow as the vagina. The ramifications of the uterus are well shown in the accompanying illustration, in which it will be seen that there is a decided median trunk, and that from this about a dozen branches proceed sideways, each forking one to three times. The eggs give to the segment, when viewed as a transparency, a characteristic appearance. Only the edges of the segment appear transparent, so fully do the uterine branches occupy the interior of the segment.

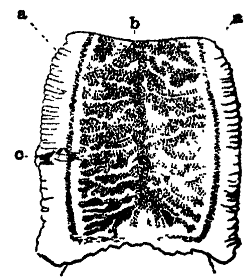


Fig. 19. A Segment of the *Taenia serrata* **of the Dog.**

a, the lateral excretory canals; b, the uterus branched and filled with eggs; c, the sexual pore. × 20.

The ripest segment observed by the writer contained about 50,000 eggs, and it may be taken that this number may be exceeded, for the uterus was not crowded with eggs, as it may sometimes become. The eggs are 36–40 x 46–49μ, averaging 36·6 x 47·4μ. Each egg is enclosed in a thin capsule, as shown in the drawing. The shells of the eggs show peculiarities not easily mistaken, for the chitin is striated radially in a pronounced manner. The embryos do not fill the shells completely. These measurements are taken from spirit specimens. The eggs are less nearly spherical than those of *Taenia marginata.*

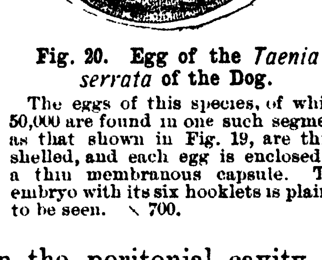


Fig. 20. Egg of the *Taenia serrata* **of the Dog.**

The eggs of this species, of which 50,000 are found in one such segment as that shown in Fig. 19, are thick shelled, and each egg is enclosed in a thin membranous capsule. The embryo with its six hooklets is plainly to be seen. × 700.

The cysts of this tapeworm are found in the peritonial cavity of rabbits and hares, both wild and tame. The cysts, like those of the sheep to be mentioned later as producing another tapeworm of the dog, retain their vitality for some time even if the discarded entrails containing them become putrid or dry up. For upwards of a week, at least, the cysts retain the power to develop into tapeworms in the intestine of the dog, should opportunity occur. It seems rather remarkable that this tapeworm is not more common than it is in this country, considering the favourable conditions offered it by its two necessary hosts, the dog and the rabbit. Probably we have to thank

the dryness of the climate in many parts of the country for this immunity, if indeed the immunity is real. My observations may not be sufficiently full to warrant saying that the parasite is rare.

Habitat.—Intestine of the dog, where it occurs, as a rule, in small numbers. Single specimen taken in Sydney, New South Wales.

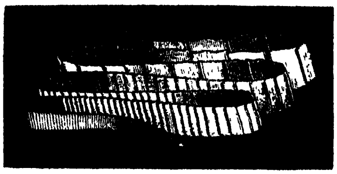


Fig. 21. Tapeworm of the Dog.
(Taenia marginata.)
Natural size.

6. *Taenia marginata,* Batsch.—The specimen figured in the adjacent cut I take to be a young specimen of *T. marginata.* This worm appears to be one of the commonest of the larger tapeworms of the dog in Australia. Not one of these large species is so common in the dog as examination has unfortunately proved to be the case for *T. echinococcus,* von Sieb., the tapeworm of the dog associated with the hydatid of man.

The following is a description of a specimen taken from a Sydney dog:—The total length, made up of about 200 segments, was 230 mm., while the greatest width, which was at the posteror extremity, was 4·2 mm. Segments in various parts of the body gave measurements as follows:—Neck, ·9 mm.; testicular, 4·2 x 1·5 mm. long; ripe, 4·2 x 5·1 mm. long. The flat or quadrangular head is about twice as wide as the neck. The latter for some 4 millimetres shows little trace of segmentation. The rather conspicuous genital pores, one to each segment, are located a little behind the middle of the margin. They are arranged irregularly, now on one side of the segment, now on the other. Each segment contains towards 20,000 thick-shelled, ellipsoidal or nearly spherical eggs, 32–34 x 36–40μ, and averaging 32 x 40μ. The embryos measure 20–24 x 24–32μ, and average 22 x 29μ.

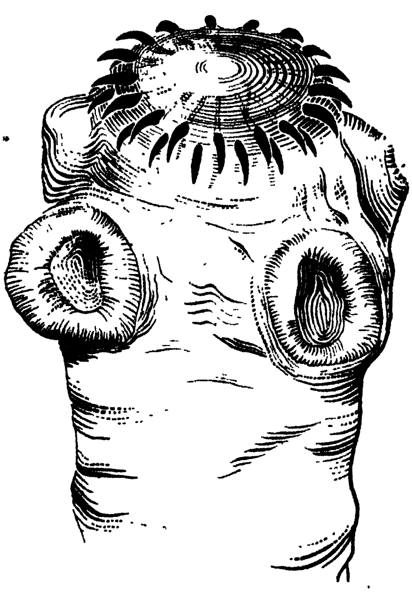


Fig. 22. Tapeworm of the Dog.
(Taenia marginata).
Scolex or "head." This is the same species as that illustrated natural size in Fig. 21. The view is a lateral one, and shows the double crown of hooklets and the four suckers. × 60.

Mr. W. Perrie, Surry Hills, Sydney, has reared this tapeworm from the cystic form found in the sheep. Writing to me on the subject, Mr. Perrie says:—"On November 4th, a young puppy, twenty-eight days old, was fed with three cystic worms. On the 13th he was given another, and on the 20th he received four more. From his birth he had been reserved for the experiment, and up to the time of his death he was carefully watched and fed. On December 14th, he was examined. In his stomach a number of *Ascaris marginata* were found. They were

quite lively, and did not seem in the least affected by the ounce of hydrocyanic acid which had killed the dog half an hour previously. In the small intestine, a short distance from the pylorus, two *Taenia*

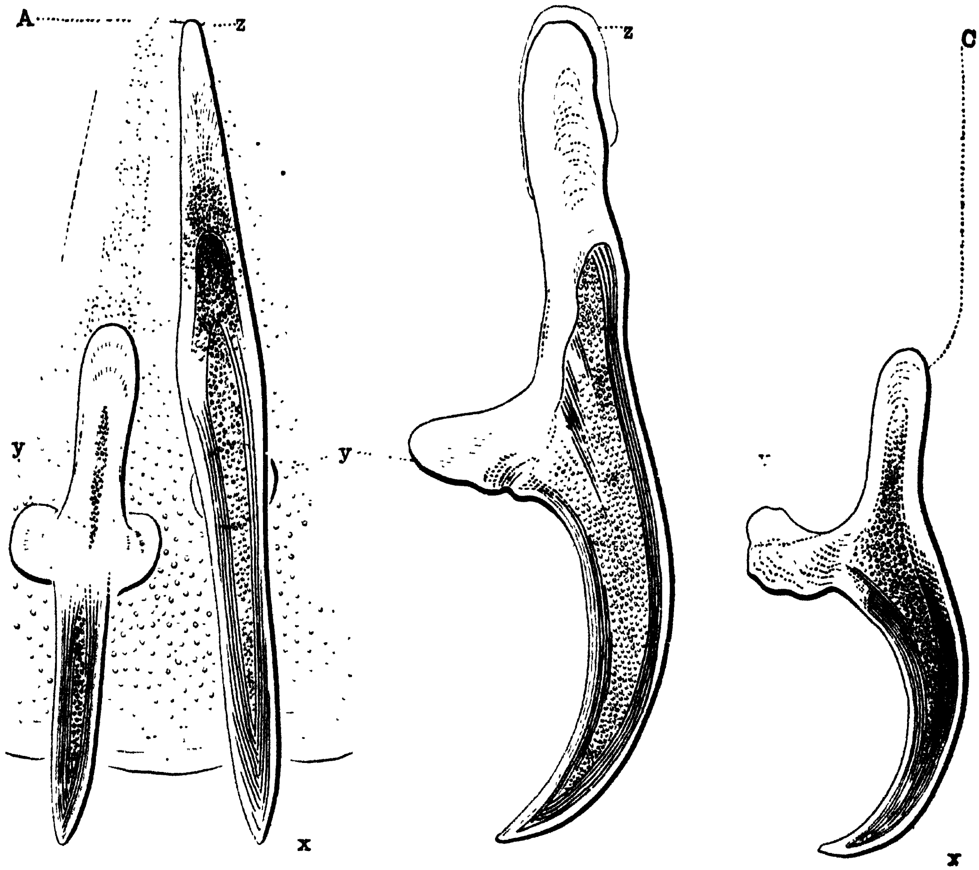


Fig. 23. Hooklets of the *Taenia marginata* of the Dog.

The same species as that illustrated in Figs. 21 and 22. A, front view of two adjacent hooklets; C, side view; x, apex or point of the hooklets; y, distal process or root for the attachment of muscle; z, proximal process or root for the attachment of muscle. × 500.

marginata were found, and a few inches from them five more. After careful examination no more were seen. The young *Taeniae* varied

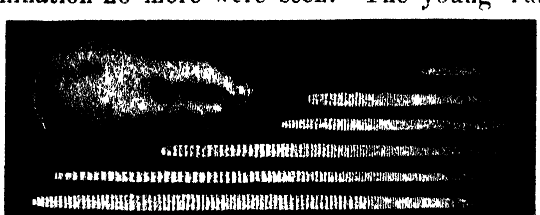


Fig. 24. *Taenia marginata*, to show the manner of the early growth of the worm in the intestine of the dog.

A single saccate cyst is shown, as taken from a sheep. Six young tapeworms of various ages are shown, these being those described in the text as reared in a puppy.

from 15 to 375 millimetres. The caudal vesicle was absent from all of them, this being due to its being opened previous to giving them to

the dog. This experiment is only a repetition of those carried out by many others, including von Siebold forty years ago. My object in repeating them was to test the vitality of the hydatid, and also to rear the *Taenia marginata*. The hydatids were taken from the putrid livers of sheep, and with one exception the cysts were also in a putrid state and of a dirty brownish colour. However, from the eight hydatids seven young *Taeniae* were produced, which goes to prove that the vitality of the embryonic worm is not impaired by the decomposition of the parts or organs to which it is attached."

Fig. 24 has been prepared from the young tapeworms described.

Habitat.—Intestine of the dog.

7. *Taenia serialis*, Baillet (?).—This is a worm of which I have seen but a single specimen, collected by Mr. Perrie from a Sydney dog. The specimen is 200 mm. long and 3·4 mm. wide at the widest part, and is composed of 160 segments. The figure gives a good idea of its appearance. The segments are quadrangular, so that the margin is not notably serrate. Segments in various parts measured as follows:—Neck, ·7 mm.; towards the posterior extremity, 3·4 x 1·3 mm.; posterior, ·9 x ·6 mm. However, the final segments yielded only immature eggs. The sexual pores, one on each segment near the middle of its margin, are irregularly bilateral. The pore is clearly indicated by the contour of the margin, as shown in the illustration.

The head is considerably wider than the neck, and bears four outward-facing well-developed suckers, and a strong rostellum, upon the summit of which is a circlet of hooklets, half a millimetre across. There are 32 hooklets, 16 of each size, arranged in perfect alternation. The longer ones are 192μ long and have the anterior process a little behind the middle, while the smaller ones are 112μ long, and have the bilobate anterior process a little in front of the middle.

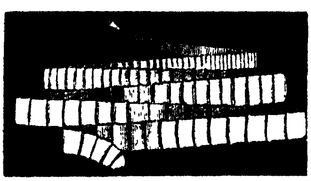


Fig. 25. Tapeworm of the Dog. (*Taenia serialis.*) Natural size.

The posterior segments contained large numbers of ellipsoidal and apparently quite immature eggs, measuring 11 x 19μ. These were nearly devoid of detail when immersed in carbolic solution, showing no trace of an embryo. From this I conclude that the mature eggs would have been most decidedly ellipsoidal.

I consider this worm to be *Taenia serialis*, though the evidence is not perfectly conclusive. *Serialis* reaches a length of 450 to 750 mm., but as the present specimen is not mature, this is no discrepancy. In our specimen the hooklets of the larger set are a little longer than recorded for *serialis*. Whether the immature ova 11 x 19μ would develop to eggs 27 x 34μ, I cannot pretend to say, though it does not seem improbable.

The Settlers' Guide.

[Continued from Page 225.]

ROBERT KALESKI,
Bulli Ranges, Liverpool.

Tools.

In bench tools we have, as previously stated, hand-saws, planes, bevel, square, gauges, rule, chisels, mallet, brace, bits, level, spokeshave, wood-rasp, bench axe, hammer, and a tool basket to hold them.

This list will be found ample for the ordinary farmer or selector; he must however, make it his business to get these of the best quality. This constant insistence on my part about the best being the cheapest may seem a bit faddish, but I speak from hard experience. Settlers who do not know mostly buy a poor set of tools to start with, get behind in their work, and never get enough cash to buy a good set (you never see a first-class man at any trade using poor tools; he knows better). Remember time is money, to the settler as well as to the business man; not a minute need be wasted, wet or dry, if a man has a good set of tools, and a shed to work in.

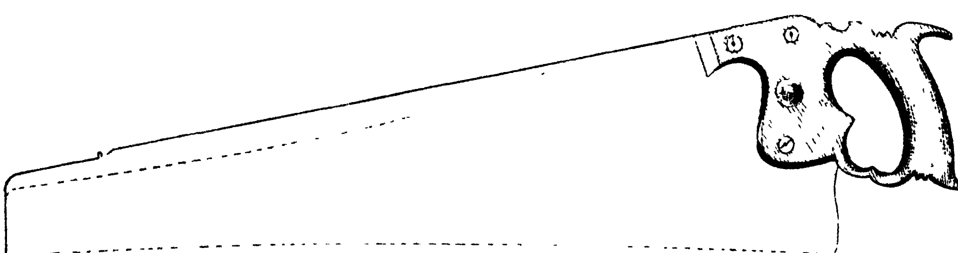


Fig. 63.

I cannot make these descriptions nearly as full as I would like, as by so doing I would require the whole of the Gazette for each article, and I was not born greedy. When the main articles are finished I will take each set of tools, wrinkles about stock buildings, etc., and show all the fine little points I know of, each in full detail, and "the reason why."

Handsaws.

We start with hand-saws; these are of four sorts (for us), the rip, the ordinary hand or panel, the key-hole, and the tenon.

The Rip.—As shown (Fig 63), length of blade, 28 inches, four teeth to the inch (Fig. 64). (The number of teeth to the inch in a saw determines its fineness or coarseness of cutting, and consequently the amount of wood it will waste). To test its quality, hold it up with one hand and ring it with the other, the same as picking a cross-cut. Then look at it to see that it is neither too thick nor thin, and try its back to make sure it is strong enough. If weak, you will feel it 'whip' or sag as

you are waving it; a weak back is the greatest fault in a hand-saw after quality, as the user cannot saw straight with it. This saw may, *like the panel saw, be either straight or hollow in the back (see illustration)*; there is no practical difference in the working, though I have listened to endless arguments about it when building. One carpenter will have a fad for the straight back, another for the hollow. I use either, impartially, myself. There is a mighty difference in the quality of brands, though; the only brand on the market at the present time that suits me is again the Disston. In this brand, however, the buyer must be careful to get his best quality. This in rip and panel saws is in the hollow-back and stamp of 112, London spring, extra refined, warranted; in the straight-back 12, London spring, extra refined, warranted, the handle has also a sort of a leaf spray carved on it. The common Disston and other brands are too much of a lottery. The price of these dear ones is about 2s. more than the common ones; the quality about double.

Fig. 64.

The Panel Saw.—This should be 26 inches long, eight teeth to the inch (Fig. 65), otherwise like the rip, same brand and quality, and picked in a similar manner. If able to afford it take an 18-inch one also of similar quality, as it will prove very useful. If not too flush of cash get a 28-inch, with six teeth to the inch, this is called a half rip, and can be used both as a rip or hand-saw. It is of course, of no use for fine work.

Fig. 65.

Tenon Saw.—This should be as shown (Fig. 66), length of blade, 14 inches, twelve teeth to the inch, the back should be steel, as it is cheaper than the brass, and just as good. Disston's make.

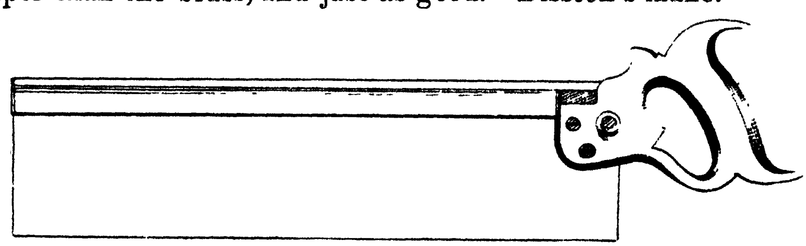


Fig. 66.

Key-hole Saw.—This has one handle (Fig. 67), as shown, detachable, and three blades, the small and middle are the ones to take, the largest is no use to you. Disston's again.

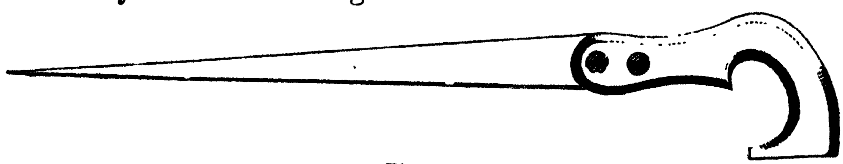


Fig. 67.

Points about Saws.

First, all saws should be used carefully so as not to buckle or twist the blade. A buckled saw will never saw the wood square, and thus

spoils work. It can be beaten out true again, but only by a skilful workman. Secondly, the blade must be kept just the right shape at the teeth so as to cut the wood properly. By the shape shown, it can be seen that either hand or rip saws cut best at the fullest point, also if sawing on another board or the bench you run no risk of cutting either. The tenon saw cuts with a straight edge, and the key-hole the same.

Always keep your saws well greased or oiled; keep them from rusting and they run easier. Neat's-foot is the only oil to use on them. Always keep good files, and with them keep the saws sharp. Sharp tools make light work.

To sharpen a panel or rip, put them in a vice. If not a good hand with tools better buy an iron Disston's saw vice, cost about 3s. I like the wooden one myself, because it is not liable to hurt the files. The saw in, set with a Morrill; then take a flat file and top the teeth down level, as in a cross-cut, being careful to shape the sweep of the blade as shown before. Now start from the point and file the point of every tooth leaning towards you holding the file as shown, with the file point slightly inclined towards the saw handle. Sharpen with the same file-edge all through, and be careful to only cut with the forward thrust, lifting out clear when coming back for each stroke. When one side is finished, turn the saw in the vice, and repeat the process. Stop filing the instant each tooth is up. If you have filed properly, the saw teeth will be as shown in the illustration of the panel saw; all saws cut with the point, and about ⅛ of the edge below it. The rip is sharpened similarly to the panel saw, excepting that the set given should be very slight, and the file angle so that the tooth is nearly square, as a rip-saw cuts like a pit-saw, with the downward thrust along the grain.

The tenon is sharpened similarly to the panel saw, but the edge should be straight.

The key-hole saw is sharpened similarly to the panel, but with a straight edge, and is not set at all.

Planes.

These consist of the tryer, jack, rabbet, smoother, tongue and groove plane. It may be remarked that the market now is flooded with iron planes competing against the wooden. In theory, these are much better than the wooden, in practice much worse. Why? Because in the first place, after being worked a few minutes, the friction makes the iron bed hot, and it will then cling to the wood being planed as tightly as Bland mud to a blanket. If you knock off every few minutes to dab the bed with oil, it will work right enough, but you need lots of time and oil. The wood plane takes much less strength to work, having a certain amount of spring in it, and not heating like the iron. Another great disadvantage of the iron tools is that being cast, they break very easily, and cannot be mended. Their only advantage is that they keep true a long time. In a few cases, it pays to use them; these will be mentioned as we go along.

Taking the trying plane, it should be as shown (Fig. 68), the best red or white beech, and of the right grain, as shown in the remarks on wood. Moseley's and Mallock's are the two best brands of planes in my estimation. Mathieson's second. The prices are in proportion to the quality. Load her with lead, as shown, below the handle and in front, to make her run heavy, as bouncing is the worst fault of a trying plane. Put an ironbark button over the front loading to hammer on when wishing to take the irons out; also round the front edge of the toat or handle, as if left sharp it cuts the forefinger. In the event of the mouth of a plane getting too open, a piece of wood can be let into the face as shown (Fig. 71); the mouth can be left any desired width.

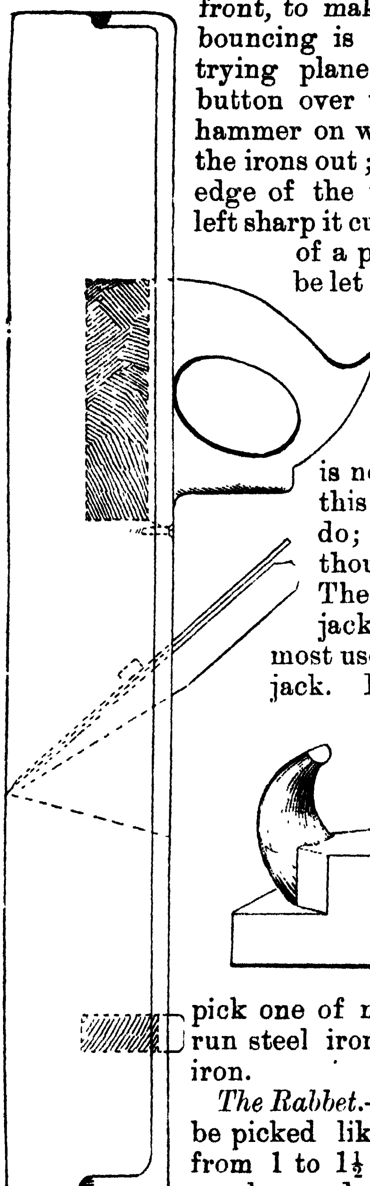


Fig. 68.

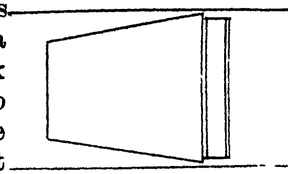


Fig. 71.

Jack Planes.—The first is the ordinary jack, as shown (Fig. 69); should be picked like the tryer. It is not necessary to load this plane, though some do; put a button on it, though, for hammering. The other is a German jack (Fig. 70), and is most useful for saving the other jack. In the latter (German) pick one of medium size, and replace the run steel iron in it with a good English iron.

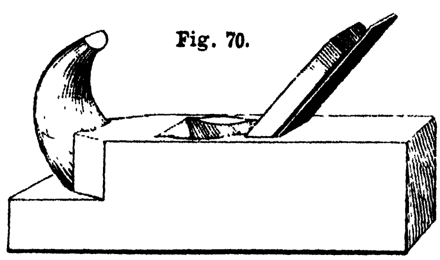


Fig. 70.

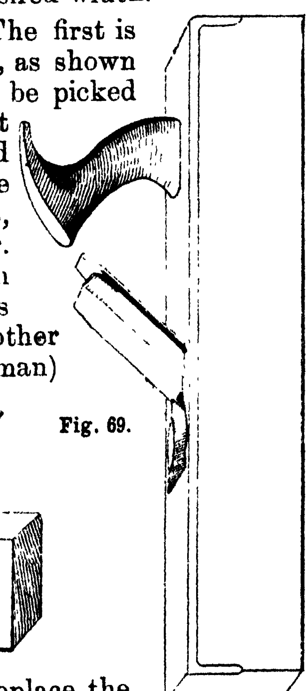


Fig. 69.

The Rabbet.—As shown (Fig. 72), should be picked like the tryer; the best size is from 1 to 1½ inches. It can be used as a filister by nailing a strip of wood on the side for a fence or guide. The iron is set on askew; some prefer them set straight, but they are not so good.

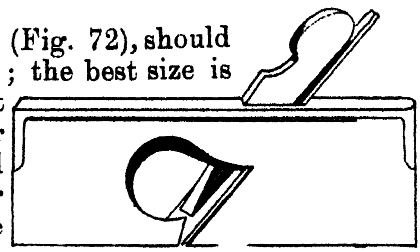


Fig. 72.

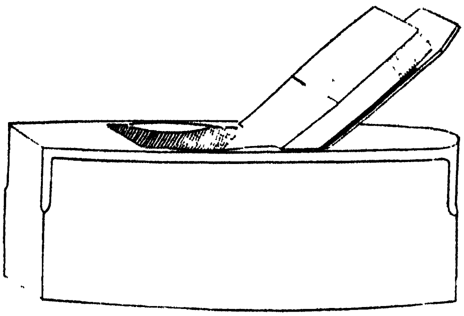


Fig. 73.

Smoother.—As shown (Fig. 73). Is picked like the others; it is not loaded; $2\frac{1}{2}$ inches is the best width.

Tongue and Groove Planes.—Are very handy for making doors, or running pit-sawn lining boards. They are of iron, as less likely to get out of truth, and are sold in pairs.

Bevel.

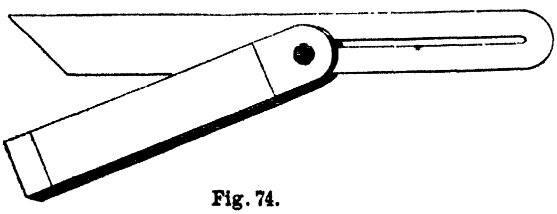


Fig. 74.

This as shown (Fig. 74) is the best, the metal ones work loose and let the bevel shift about, which spoils building.

Square.

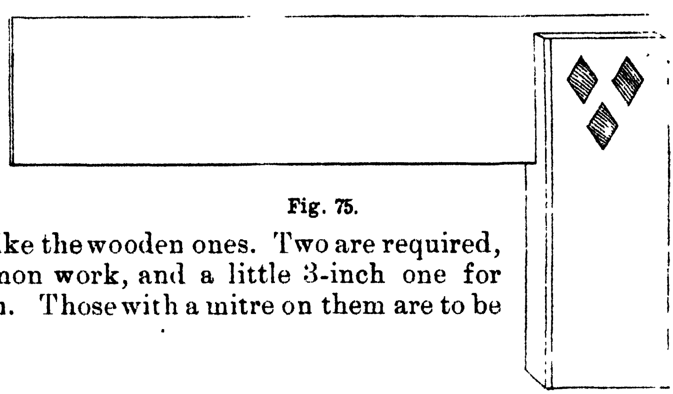


Fig. 75.

As shown (Fig. 75), may be either iron or wood. I prefer the iron, as though dearer they are not liable to get out of truth like the wooden ones. Two are required, a 10-inch for common work, and a little 3-inch one for squaring edges with. Those with a mitre on them are to be preferred.

Gauges.

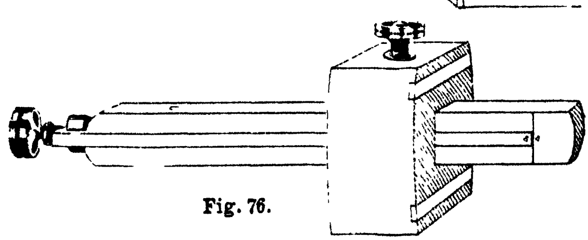


Fig. 76.

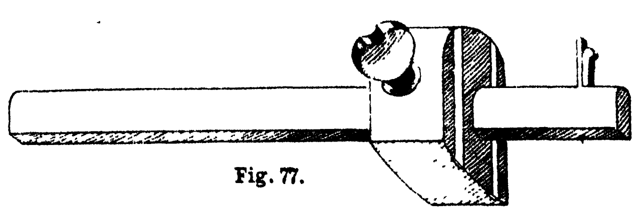


Fig. 77.

As shown, Marple's morticing (Fig. 76) and marking (Fig. 77), of beech, brass-plated. For a cutting gauge, you can put a steel blade in the other end of the marking gauge. The all-wood gauges get out of truth quickly, whilst the brass-faced ones are too heavy to use.

Rule.

Should be of box, 2 feet long, with brass-bound edges. Raebone's make; the 3 feet rules are quicker, but too awkward to carry.

Chisels.

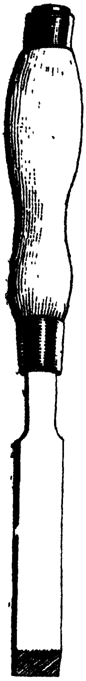


Fig. 78.

These are of three sorts, the firmer for paring, the socket and registered (Fig. 78) for mortising. I think Marple's, or Ward and Payne's the best on the market just now, a 1½ inch, and a ¼ inch firmer, both bevelled 1 inch and 1½ inches of the sockets, and a ¼, ⅜, ⅝, and a 1 inch, of the registered, are all that will be necessary.

Mallet.

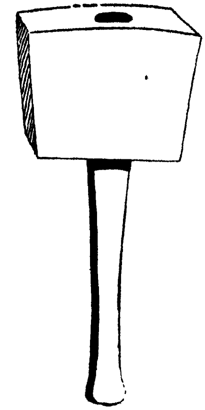


Fig. 79.

As shown (Fig. 79), of black lignum vitæ, the heavier the better; the beech are too light, and take too much force. See that the grain is right, no little rings just on the edge, as these chew out in working.

Brace.

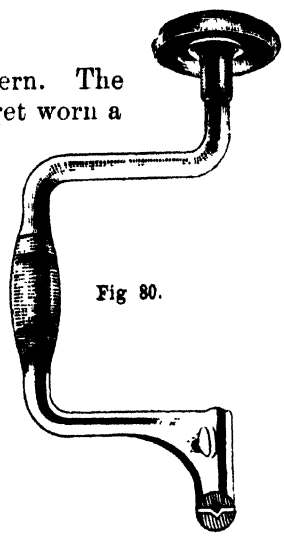


Fig 80.

As shown (Fig. 80), Spofford's pattern. The ratchet braces are good till the parts get worn a bit, when the brace does not hold. The cheap brace, with the ring clutch, only holds when boring in. You want to carry a little hand-vice when using it, to get the bit out with.

Bits.

These are of two sorts for us, augur bits, and cobra bits. A ¼ inch, a ⅜, a ⅝ and a 1 inch augur bits are needed; of the cobra, 6 from the smallest size up. Then another bit called a counter-sink, very useful for cleaning holes for screw-heads.

Level.

As shown, of Stanley or Disston's make (Fig. 81). I prefer the ordinary ones, not the adjustable, as these latter vary too much. 2 feet

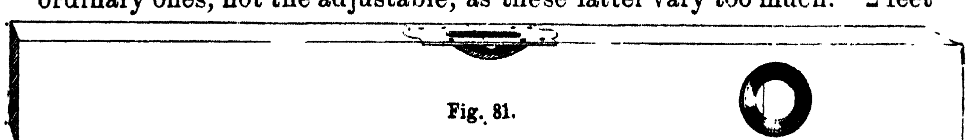


Fig. 81.

4 inches is the handiest size, the smaller ones not being long enough to tell a true surface. It should be brass shod at the ends, as it is here the greatest wearing takes place.

Spokeshave.

Of iron, shape as shown (Fig. 82). This is the handiest spokeshave, though a beech one is easier to work.

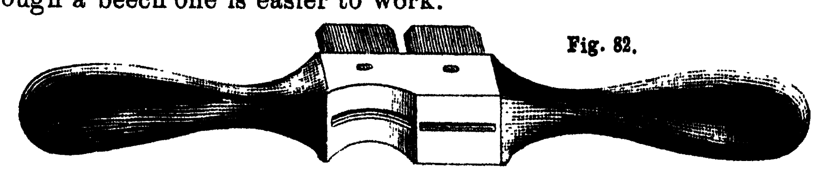


Fig. 82.

Wood-rasp.

As shown (Fig. 83), 8 to 9 inches long.

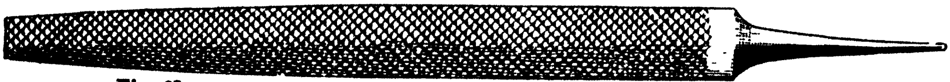


Fig. 83.

Bench axe.

This being simply a little squaring axe, very useful for small squaring work.

Hammer.

There is only one make I know of on the market to use, and that is Cheney's (Fig. 84). The middle size is the handiest, the largest size being rather too heavy for indoor work. None of these hammers are set properly when you get them from the shop, so you must set yours yourself (see illustration). To do this, prize out the iron wedges with the handle end of a file. Knock the handle out, and ease it at the top of the front and the bottom of the back. Now put the head on again and wedge it; your hammer will now be set right, that is, the fingers have plenty of clearance when the face is flat on the board; when the set is the other way, the fingers hit the board or flooring before the hammer-face, which is unpleasant.

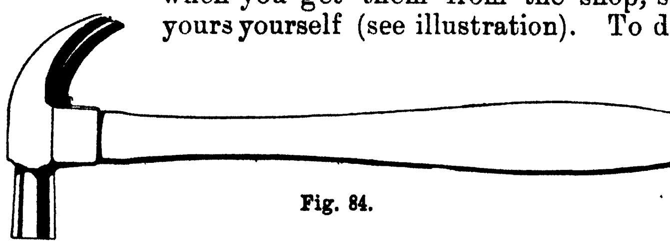


Fig. 84.

Screw-driver.

Medium size. Marple's is the best on the market.

Tool-basket.

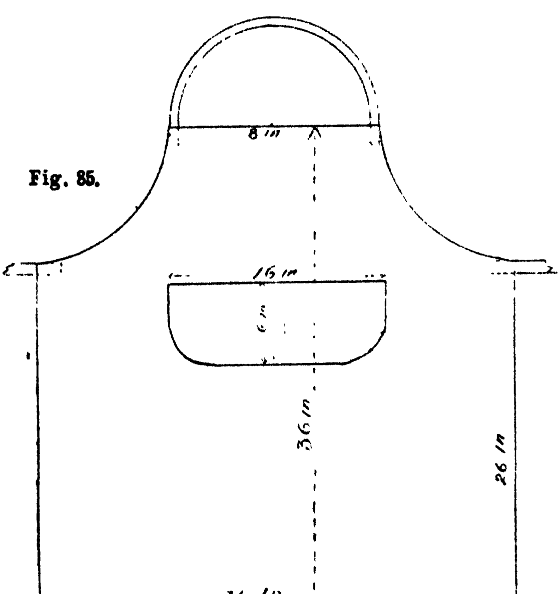
This is to hold the tools if working away. It should be medium size, and brown canvas; this will outwear two common baskets.

Apron (Fig. 85).

A yard of unbleached calico makes two of these. They are very useful for building work, saving the clothes a lot.

The pocket is joined down the centre, the left side holding nails, and the right the rule and pencil.

Fig. 85.



Stamp.

Your name or initials, is of steel, costs about 5s., and saves many squabbles as to ownership of tools.

Tool Box.

A strong box, with a stronger lock, should be provided to keep the tools in when not in use. This is to save them from a pest with which most selectors are cursed. This pest is very troublesome; it generally lives close by, and drifts up about tea-time, eats a big feed, and after a little beating about the bush, timidly asks you for the loan of a few tools till Saturday. If you are soft, it departs in triumph with the best part of them; when done with (in a couple of months), you may get a few of them back if it has not lent or sold them to its relations further out. Those you do save will be pretty well spoiled. The pest, if you bail it up by any chance, will solemnly affirm that "it was like that when I got it." If you fell it, as any right-minded person will do, it runs into town as soon as able and takes out a summons against you for assault! On the other hand, the borrower may be a decent neighbour, so do like I do, and keep a lending set of tools as well as your good ones. These can be bought out of a dealer's yard for a few pence, and rubbed up a bit clean with sand. Then when a borrower calls, lend him some of these; if he returns them properly sharpened and done up, it is safe to lend him a few (very few), of your good ones.

I left my set on the last selection I had, on the Dorrigo; they have broken in many a cocky. There was a cross-cut saw in particular, I prized above rubies. It was over 40 years old, about ¾ of an inch thick, and of a metal unknown to science. The man was never born that could make it cut; no file could hurt it either. I lent it to one notorious borrower on the Dorrigo soon after I got there; he came back early next morning with it, panting.

"Say, mister, this saw won't cut at all," he told me.

"Not cut?" I answered in a surprised tone. "Oh, you want to give her a touch up with the file, I expect."

He departed, but was soon back, and leaned the old warrior up against the slabs without a word. I could see a few heel-dints on the blade where he had jumped on her in his excitement. Then he said insinuatingly:

"Got any other saw y' c'n len' me?"

"No." I told him diplomatically, "My other tools are coming by the next boat."

His face fell at this, the next boat being anything up to two months, according to the humour of the Bellinger bar. To cheer him, I showed him the rest of my lending tools; and offered him any of them. He shook his head sadly, and went home again. Then he spread a report round the Scrub that I was a bad man, and would be a disgrace to the district. Some people have a funny idea of gratitude!

(*To be continued.*)

Pisé and Adobe Buildings for Dwellings, Dairies, and Store-rooms.

So many inquiries have been made with regard to buildings of Pisé that it has been thought advisable to republish some information on the subject with some new illustrations. It is hoped that with this assistance no difficulty will be found in carrying out the work.

There are two kinds of building material within everyone's reach. They are not only cheap, but by their use store-houses and even residences can be made to excel in points of dryness, coolness, warmth, durability and immunity from fire. Unfortunately these two excellent materials bear outlandish names, viz.: Pisé, which is merely rammed earth, and Adobe, which is sun-dried brick. The ancients appreciated both,—especially the sun-dried bricks—and it is probable that these "mud pies" were the first articles manufactured by man. Most people will remember too the big strike that took place some years ago at Pharoah's brick-works. For the greater portion of the details concerning these materials the writer is indebted to the *Handbook of Mechanical Arts*, by Robert Scott Burn. His particulars have merely been amended here and there to bring the information more in conformity with the conditions of New South Wales.

Pisé, or Rammed Earth.

The Kind of Earth or Soil Suitable for Pisé.

The kind of earth or soil best adapted for pisé is that known as gravelly. By this term is meant a soil in which the pebbles or stones are round, not flat or angular. The soils usually chosen for brick-making are suitable for pisé, but owing to the capacity for moisture they are apt to crack unless carefully shielded from the wet during the process of drying the walls. All kinds of earth, however, may be used, with the exception of light sandy soils and strong clays; these, however, will do if judiciously mixed with better-fitted soil—*i.e.*, a light earth may be blended with a strong soil, and a clay may be mixed with sandy or gravelly soil. Where the best kind of soil that is gravelly cannot be obtained, small round pebbles (ant-beds), may be mixed with it. All animal and vegetable substances that are apt to soon decay must be carefully kept out of the soil to be used. The following indications, which may be observed in order to judge of the fitness of the soil for pisé in any district, may be useful:—In digging, if the spade brings up large lumps at a time, the soil is well adapted for the work; this holds also where the soil lies in cultivated

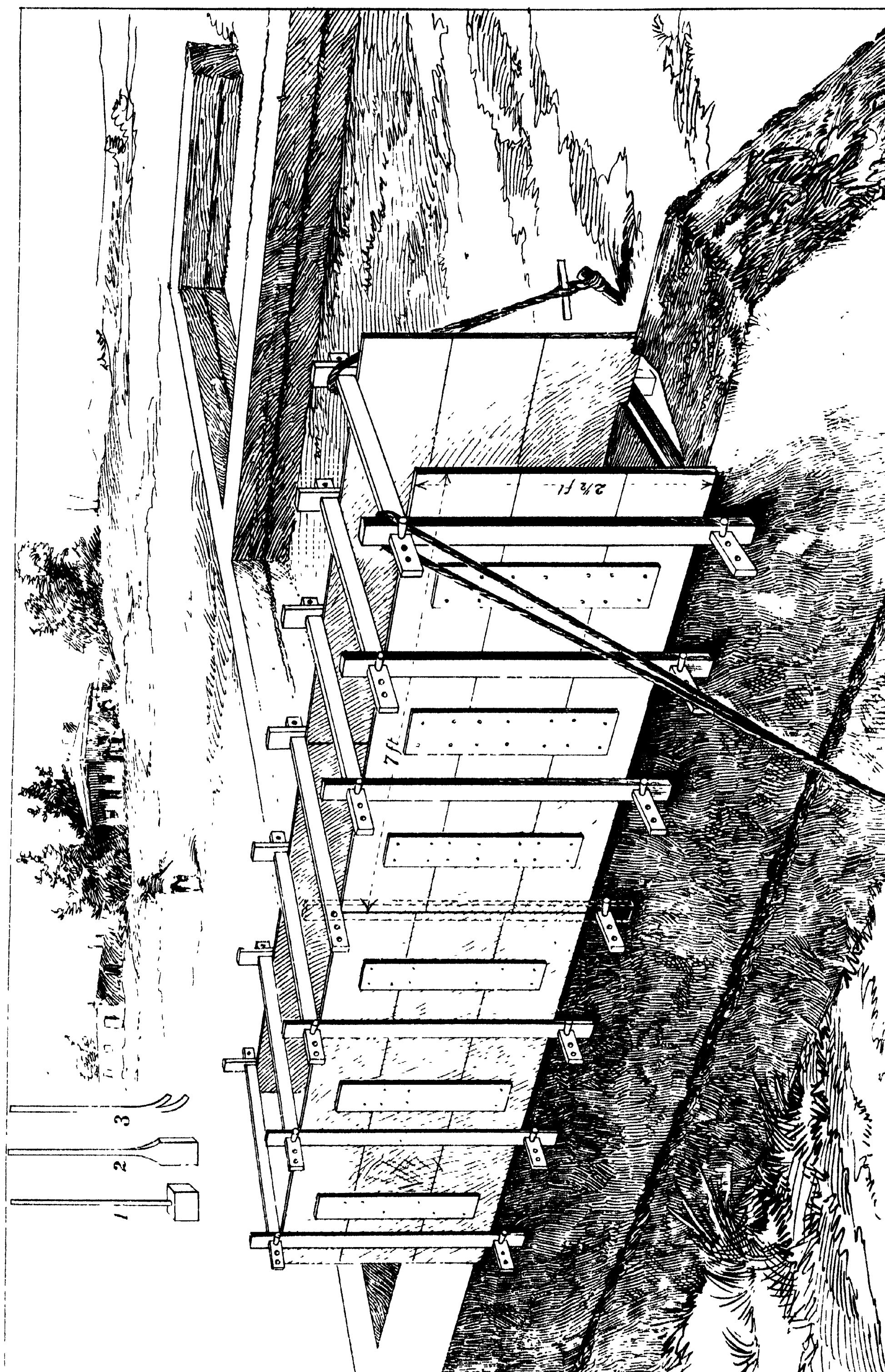
land in large clods and binds after a heavy shower and a hot sun. Where vermin holes are smooth in the inside and firm, or where the small lumps found in the fields are difficult to be crumbled between the fingers, the soil is good for the purpose. Soil of suitable quality is generally to be found at the bottom of slopes that are in cultivation, and on the banks of rivers.

Preparing the Soil.

In preparing the earth for building, the first operation is breaking the clods or lumps, and thereafter placing the soil in a conical heap; this form facilitates the removal of large, flat, circular stones, which, falling to the bottom, are easily removed from the mass by means of a rake. The teeth of the rake should be placed at intervals of an inch or thereabouts, so that only stones exceeding this in size may be withdrawn; or what would be better and quicker, a bricklayer's sieve or screen might be used, having the meshes an inch square. Where two kinds of soil are to be mixed, the operation should be done at this stage. Enough of soil should be prepared to last a day's working only. Care must be taken to prevent rain saturating the earth, as in this case it will form mere mud in the mould. It is necessary to note that the soil is in the best condition for working when neither too dry nor too wet. Less time will be lost in slightly wetting the soil when too dry, than in waiting for it to become dry after saturation by rain in a careless exposure.

The Moulds.

Burn says on this point: The moulds should be made of clean, thin, planks of pine, or other light wood, well seasoned to lessen the chances of their warping. Their thickness should be about an inch, well planed on both sides. The length should be from 12 to 14 feet for ordinary work; but shorter moulds will be at times found useful. The depth of the mould should be 14 inches—some recommend up to 2 feet 9 inches—but a practical experiment where the lesser depth was adopted, showed that it was more convenient than the greater, giving at the same time greater facilities for detecting error in carrying up the walls. The two sides of the mould, of whatever depth, are formed of one broad piece of timber, or of several narrow boards tongued and grooved, and fastened on the outside of the frame by battens nailed at intervals of 30 inches or thereabouts. To facilitate handling of the frames iron handles may be attached. In forming the angles of the building, a separate mould or frame is required; this should be of the same depth as the other, but having battens at each end only and these in the inside. The battens should be securely fastened with screws, as wire nails are apt to start. The use of these battens is to prevent the head of the mould from springing out when forming the ends of the wall. The pressure being outward, the head of the mould must evidently be of the same depth as the mould, and its width equal to the intended width of the wall. Other details are given as to the construction of the moulds, but for Australian conditions experience has proved that excellent results can be achieved by



MOULDS FOR PISE BUILDING.

the use of moulds such as Mr. W. J. Pleffer, of Wyndella, Armidale, described in in the *Agricultural Gazette* in September, 1897. For the information of those interested in the subject who may not have seen Mr. Pleffer's recommendation, his note is reproduced here:—

How to make a Pisé or Mud Wall.

Procure some ½ inch rod iron; cut it in lengths of 1 foot 8 inches, sixteen lengths in all; make bolt heads on one end, and at 14½ inches and 17½ inches from head punch holes to receive a key. You also want sixteen lengths of flat iron 15 inches long, 1¼ inch wide, by ½ inch thick, with a hole punched in each end. Not less than three pairs of boards are required, in lengths of 6, 8, and 10 feet, 1 inch thick by 1 foot wide. Kauri pine is the best, being light and strong. To fit the boards, run a rod through each pair of flat iron pieces, and if a 1 foot wall is required put key in 14½-inch hole; if thicker, key the other hole (I prefer outer walls 1 foot 3 inches thick); rest the boards on the rods; draw the flat pieces up vertically, and insert the other rods; put two sticks crosswise in each box to make them rigid; fill in the mud and ram; smooth each course on top and remove the boards. In two days it will be dry enough to receive another course. A bolt with a nut on it is fixed to the end of one board to turn corners. Any kind of soil excepting clay will do to build with, but the poorer the better. I prefer an ironstone gravel; mix it up soft, and let it stand in a heap for a day or two; it will then ram in firm, and set like a rock. Window and door frames may be built in, or the openings left and the frames fixed in after. Mud walls, whilst being constructed, must be protected from rain.

Erecting the Building.

The foundation of the building, according to Burn, should be of stone or brick for at least 18 inches above the ground. In moist climates, no doubt such a precaution is necessary, but for local conditions 6 or 8 inches above the ground would be quite high enough for the foundations. When a floor of wood is to be used, the joists may rest on the flange of the foundation, or places for them may be provided in the first course of pisé by placing in the frames suitable sized pieces of wood, or something that can be afterwards removed.

The boards are set in position for the first course, and work on it is continued until the whole course is completed, using short lengths of boards when leaving openings for doors. Then the next course is laid, care being taken before filling-in commences to see, by means of the plumb-line, that the exact perpendicular is being preserved.

In filling, only a small quantity of earth at a time should be rammed, so as to ensure complete compactness.

For doors and windows, ordinary frames may be used, set in position and fastened to guards of timber that are wide enough to overlap an eighth of an inch or so over the outside of the wall; for instance, for a wall of 12 inches wide, a door-frame plate 12¼ inches wide could be used.

Bond timbers may be used if desired. They should be in breadth equal to one-third the thickness of the wall. As they are completely embedded in the rammed earth as the work proceeds, they will last practically for ever. It would not be a bad idea, however, to give timber used for such a purpose a dressing of crude kerosene oil to protect it from white ants. Such timbers, if care be taken to locate their position, are handy to affix shelving to. Unless they are provided, wood bricks should be built in here and there to carry nails.

Adobe or unburnt bricks.

To a good many people unburnt bricks will commend themselves as a most suitable material for store-houses. Burn, in the work mentioned, says :—

To make these, any ordinary clay will answer. If dry when obtained, it must first be moistened and thoroughly worked by the feet of cattle, or pounded (or pugged) by hand. Cut some straw into pieces about 6 inches in length. After being carefully mixed with the straw, the clay is ready to be made into bricks. A mould of any desired size, according to the thickness of the proposed wall, may be used. For ordinary purposes, a 12-inch wall will be found best. The mould for the bricks to be used in such a wall should be 12 inches long, 6 inches wide and 5 inches deep; this mould should have a bottom, but not air-tight or the brick will stick in it. The clay is put into the mould and the brick is formed in the same way as the ordinary burnt brick. Should the clay be tenacious, a little sand sprinkled in the mould will enable the brick to leave it freely. The bricks as moulded are placed on level ground to dry, being turned on their edges on the second day; thereafter they are left in piles, protected from the rain, for ten or twelve days.

The foundation of the building should be formed of stone or burnt bricks, and to prevent damp rising, a damp course should be laid above the footings.

To obtain the necessary bond in the walls, the work is carried up in alternate courses of headers and stretchers—one course having the bricks laid across the wall, the next course having them side by side. A good ordinary brick mortar is to be preferred, although a weak mortar of lime and any fairly sharp sand will do for laying the bricks.

The door and window frames should be made previously in readiness for insertion as required. The frames should be of stout plank exactly the thickness of the walls; they will thus help to cover the joints and strengthen the work. Lintels and sills of stone, when easily to be had, will greatly improve the appearance of the structure; but timber about 3 inches in thickness, and of a width equal to that of the walls may be used in place of the stone. These should have a clear bearing of at least 12 inches on each side of the opening.

Where a nice finish is required, the outside walls may be plastered with lime-mortar mixed with hair, and then with a second coat pebble-dashed as in rough cast. But, for ordinary purposes, an occasional coat of well-made limewash is all that will be required.

Roofing.

Of whatever kind the roof is, it is essential in this form of material for outside walls that it should be an overlapping one, in order to protect the walls from vertical rains.

Galvanized iron for roofing meets nearly all the requirements, provided reasonable care be taken to line it or leave air-spaces between the outer iron roof and an inner false roof of boards or some other material.

On Building in Pisé.

On several occasions attention has been drawn in the *Gazette* to the suitability of Pisé (rammed earth) for the construction of store-houses and buildings of all kinds in which uniformity of temperature is desirable.

The following particulars of this work, as carried out in India, where Pisé is not only one of the chief materials for the construction of native dwellings, but is also largely used in the erection of public buildings, are from a *Manual on Earthwork*, edited by Col. R. MacLagan, R.E. (Indian Engineering, Vol. II.).

Pisé is a method of constructing solid walls of rammed earth, the form and dimensions of the walls being regulated by a temporary casing of strong planks within which the earth is rammed. A hard, solid structure is thus produced, of great firmness and durability, even under exposure to extremes of temperature and varieties of weather. The following is a description of the ordinary method of proceeding, taken chiefly from that in practice in the South of France, where this kind of construction is frequent:—

The wooden casing is made of stout, smooth planks (the adjoining edges of which may, for greater security, be ploughed or grooved and tongued), strengthened by cross planks, firmly nailed or screwed to the former to prevent them from warping. Similar boardings are erected on both sides of the intended wall, and they are retained in their relative positions at the required distance apart by upright stanchions inserted at foot in cross-pieces. The insertion is in long mortises, which, besides the tenon at the foot of the uprights, receive wedges by means of which the distance apart of the two sides is regulated. Walls in Pisé are generally made to diminish in thickness towards the top.

These cross-pieces, as the work proceeds, become so firmly embedded in the wall that there is great difficulty in extracting them, to remedy which iron bars have been substituted. Even these thin iron bars become so tightly jammed when surrounded by the compact Pisé earth, that much labour and risk of injury to the work is incurred in extricating them, and the expedient of setting them in a bed of sand has been successfully resorted to. They are then drawn out with care, the sand also is removed, and the holes which they leave are subsequently filled with the same earth of which the wall is made, and rammed hard.

This difficulty in the use of wooden bars does not seem to have been experienced to the same extent in Pisé construction in the

Madras Presidency, described in the first volume of the Professional Papers of the Madras Engineers. It is stated that several heavy blows of a mallet on the narrow end were required, after which their tapering form made it easy to withdraw them. The soil, it is true, was in this case found afterwards, on the destruction of part of the wall by rain, so sandy as to be in the opinion of the engineer unfit for the construction of such a wall; but, when subsequently improved, by an admixture of potter's earth, the work progressed satisfactorily, and no allusion is made to any increased difficulty in the removal of the bars. Tapering bars are not stated to be used in the French Pisé works, nor were they in the first attempts at Bareilly. The heads of the opposite uprights are held together by ropes as shown in the figure; but in practice in India it has been found that under the immense pressure exerted upon the plank sides by the earth firmly rammed in the interior, the ropes are so liable to stretch and to break that it is advisable to use iron rods or bars in this position also. When ropes are used, the distance between the side planks is measured by gauge-rods and the ropes tightened when requisite to preserve the proper breadth of wall. The use of iron connecting-rods renders this unnecessary. The head of the first portion of the work is closed with a piece of planking.

Soil of medium quality, that is neither very stiff nor very sandy, is considered best adapted for Pisé. It may be said that that which would make good bricks will answer well for this description of work. The natural moisture of many soils is sufficient, requiring no water to be added, to make it cohere in a compact mass when rammed. When the earth is very dry, a sprinkling of water will be necessary. It is usual to begin the work upon a foundation of brick or masonry; but there seems to be no reason where the Pisé might not be used from the commencement, even for foundations under ground, being carefully guarded from all chance of injury by running water.

The casing being prepared and erected, and the upper surface of the old work, when above the first stage, being sprinkled with water, the earth well mixed and slightly moistened, is thrown in and spread in thin layers of four or five inches. These should, when rammed, be reduced to one-half their original thickness. The rammers should be of hardwood and very smooth. The successive layers are similarly treated, and thus the work proceeds until the top of the casing is reached. The ends of each portion should be finished with a slope, to which will be joined the portion next to be added longitudinally. These joinings should not, in the successive courses, be above those of the lower stage, but as in masonry and brickwork, should "break joint." These seams are all distinctly perceptible when the work is complete. If it be desired to remedy this, either the wall may have a coating of plaster, or the surface may be simply smoothed and dressed with a shovel or similar implement. When it is to be plastered, it is necessary that the wall should first be thoroughly dry. If dry externally only whilst damp within, it has been found that the moisture is apt subsequently to attack the plaster and cause it to fall off in flakes. Without plaster, good Pisé work is found successfully

to withstand exposure to the weather, and after the lapse of many years to be so compact and hard as to be picked down with difficulty. Where the wall is not that of a roofed building, it must be provided with a coping, having a good projection to protect it from rain.

MR. F. WILLIAMS, collector and magistrate at Bareilly, adds the following notes, based on experience in building a gaol at that place:—

The most convenient length of planking is about 10 ft.; the height of the box-work, 2 ft. 6 in. to 3 ft. Mr. Williams recommends a timber locally known as suitable for boat planks, but Mr. J. Pridham, of the Public Works Department, Sydney, to whom we are indebted for the opportunity of publishing the information on Pisé now given, states that the best wood for this work in Australia is Californian red pine.

The substitution of iron connecting bars for wooden ones has been mentioned above. The evils of the wooden arrangement were found to be the starting of the wedges, the fracture of the tenons, the tight jambing of the bars in the wall, and the injury to the walls and to the bars themselves from the force requisite to be applied for extracting them. The lower iron connecting bars are made 3½ in. by ½ in.; the upper, 1 in. by ⅜ or ¼ of in. each, having holes ½ in. by ¼ in., with corresponding pins.

The mode of setting the bars and arranging the work on each successive elevation of the casing is to cut in the surface of the completed part of the wall a groove 1 in. wider than the bar, filling it in, after placing the bar, with sand to the level of the wall's surface. The side boarding being set up, the vacant space left along the bevelled edge of the previous course is filled up with moist clay to retain the first layer of the new course. The end pieces are secured by iron bars or rods, with screws or nuts or pins as shown. A convenient arrangement might be to make the lower and upper connecting bars alike, to raise the side boarding a few inches above the upper bars, which, when embedded, might be allowed to remain and become the lower ones of the next course, the external apparatus being shifted by taking out the pins and slipping off the stanchions and planks, to be re-applied to the upper bars already in position to receive them. Three days is the length of time required for executing the same extent of wall 2ft. 6 in. high and 3 ft. thick; two days when 2 ft. thick. The work cannot with any advantage be much accelerated. Gentle and quiet ramming has been found most effectual. For preserving the surface a rough-cast plaster of coarse sand, small limestone nodules (Mr. Pridham says gravel would do as well) and lime, thrown on with the hand, was found the best kind of external application. But the latest mode adopted is to place on the edge of each layer of earth, in contact with the plank sides, rows of pieces of tile, to be embedded three or four inches in the wall, and along with these, to a somewhat less depth in the wall, a mixture of lime, very finely pounded bricks, and pieces of broken brick. This is slightly moistened, and being rammed similarly to the rest of the work, becomes when finished, a sort of permanent facing to the wall. This will more readily receive plaster than earthen Pisé, if further exterior finish is desired.

REPORT on Pisé work executed at Etah Gaol by Mr. N. SPRENGER, assistant-engineer.

The boxes used consist of two wooden frames, 10 feet long and 2½ feet wide, made of planks nailed on to stout battens. They are held together by four pairs of posts, 3 inches by 3 inches, which are connected above and below with tie-bars of flat iron, 1½ inches x ¼ inch. The tie-bars have at each end a certain number of holes punched in them to receive pins, for the purpose of preventing the posts from slipping off. By changing the pins, walls of any given dimensions can be obtained, wedges of hardwood, with longitudinal slots, are introduced between the posts and the pins, to adjust the breadth of the box to a standard gauge. After the boxes are fixed and adjusted, they are secured in their position by ropes passing over them and tied to stakes at each side. Any deflection from the vertical should be corrected at the commencement of the work, as it is impossible to alter the position of a box after it is half full. Generally, fresh earth contains sufficient moisture to ensure good consolidation; but if is found that it jumps under the rammers, it should, on being thrown into the boxes, be sprinkled with a little water out of a tin-can with a rose. The watering should be as uniform as possible, or if it is applied unequally it will liquefy the earth, which will commence oozing out under the rammers. Pisé work executed with too much water is worse than if done with dry earth, as on account of the elasticity of wet earth, the effect of the ramming is deadened, and the earth remains unconsolidated. If the workmen keep time in ramming, they will cause vibration, which is injurious to the stability of the wall. On working over a lower course, it is as well to let the lower tie-bars about 4 inches into the same, to give the boxes a firm hold on the old work, thereby the joints become imperceptible, and the upper edge of the lower course is prevented from chipping off.

During the course of carrying out the work upon which Mr. Sprenger's notes are based, there was, on more than one occasion during two months, a downpour of rain. The Pisé wall was scarcely affected at all, while sun-dried brickwork of the same age in the vicinity was very much cut up and honeycombed, and had to be plastered with cow-dung to preserve it.

SPEAKING of the method in which the boxes are filled and the walls are carried up, Mr. E. BATTIE, Elec. Engineer, 5th Division, Grand Trunk Road, says:—

In the morning the boxes were taken down and again put up, and filled during the day; they were left during the night so that the earth might detach itself from the sides. It is not advisable to allow a course to dry thoroughly, as the upper one will not bind well into it, but probably show a crack. If the earth is well rammed, and only the proper quantity of moisture admitted, a second course can be commenced immediately. In buildings in which Pisé work is likely to be used, this would seldom be necessary. The Etah Gaol wall, it might be mentioned, is 2,700 feet in length. The illustrations will show clearly how the frames above referred to are constructed.

Mixed Farming.

Operations at Bathurst Experimental Farm.

R. W. PEACOCK.

Mixed farming is inseparably connected with the retention of the fertility of the soil, and also with the renovation of areas which have been devoted to grain crops principally for so many years that now the returns are not profitable.

Mixed farming allows of rotations being followed of inestimable value to ensure long sustained soil fertility. It also allows of monetary returns being available at various seasons of the year instead of only once in twelve months as when wheat-growing alone is followed. It provides for a rational division of labour for men and teams. It minimises the risks of heavy losses such as are possible when all is staked upon one large line of agriculture. It gives variety of occupation which is one of the best features of rural life. The practical man is able to fully understand and appreciate the above advantages.

In order to demonstrate the results of such a system and its possibilities I will endeavour to tabulate some of the leading lines at the Bathurst Experimental Farm for the years 1903–1904.

In order to fully understand the following figures, it will be necessary to give a brief description of the farm, and afterwards to allow the farmer to sift and weigh the results, placing his own value upon them.

The farm comprises 610 acres, 594 of which are situated upon the uplands, and can be fitly described as typical wheat lands of the Bathurst district. Sixteen acres are situated upon the bank of the Macquarie River, and is representative of the rich alluvial deposit of that river. It is irrigated and devoted to the growth of fodder crops and vegetables. The fodder crops are consumed by the pigs and cows of the farm.

Of the upland area 400 acres are cultivated, the balance being unimproved bush land, with creeks and broken gullies of no agricultural value.

The stock kept upon the farm for 1903–04 comprised :—

235 ewes and their lambs, totalling 450 sheep.
20 head of horses, 25 head of cattle, and 60 pigs.

The crops grown comprised the following:—

Wheat, 99 acres, yielding	... 2,634 bushels.	Straw ..	90 tons.
Maize... ..	780 ,,	Hay ...	40 ,,
Oats	610 ,,	Mangels ...	93 ,,
Barleys ...	271 ,,	Potatoes ...	19 tons 15 cwt.
Ryes	120 ,,	Onions ...	11 ,, 5 ,,
Sorghums and millet seed...	16 cwt.	Pumpkins...	8 ,,
Ensilage ...	120 tons.	Melons ...	12 ,,
		Turnips ...	5 ,,
		Fruit ..	3,000 cases.

A large number of miscellaneous crops were also grown.

In carrying out the rotations in the farm practice sheep were principally catered for, and a list of the crops entering into their dietary for twelve months should prove interesting.

January	grazed	on stubble paddocks,	lucerne and cowpeas.
February	,,	,,	and cowpeas.
March	,,	,,	lucerne and cowpeas.
April	,,	,,	,,
May	,,	,,	rape and lucerne.
June	,,	early wheat, rape, and in bush paddock.	
July	,,	rape, stubble, and in bush paddock.	
August	,,	,, ,,	
September	,,	rape, fallow, and in bush paddock.	
October	,,	rape, crimson clover, and fallow paddock.	
November	,,	black tares, sheep's burnet, prairie grass, and in fallow paddocks.	
December	,,	black tares, lucerne, fallow and stubble paddocks.	

It will be seen from the above that there are many crops from which to choose to allow of rotations upon approved lines.

For winter feeding, rape, black tares, and early sown wheats are principally to be relied upon.

For spring feeding, rape, crimson clover, tares, prairie grass, and sheep's burnet are valuable.

For summer and autumn feeding, lucerne, cowpeas, and stubble paddocks furnish the bulk of the food.

By such practice it is possible to keep the ewes and lambs in good condition, and also allows of the lambs being marketed at profitable prices.

The production of fat lambs for export should, in the future, be one of the most important lines for farmers who are desirous of making the most out of their farms, at the same time keeping up the natural fertility which, when once lost, is very hard to regain.

The effects of such crops, when grown intelligently, upon the general economy of the farm, will be treated upon in a future article upon the "Rotation of Crops."

Field Crops at Wagga Experimental Farm.

WHEAT.

G. M. McKEOWN.

THE land used during the past season for wheat-growing is situated on the lower part of the farm, on which the soil is not the typical red soil of the district. It consists chiefly of greyish loam of varying depth and texture, and it is not so retentive of moisture as the red soil.

In order to secure a fair average of the soil in every block, each was made to run the whole length of the paddock, 46 chains.

In the portion of the paddock occupied by Hudson's Early Purple Straw, there are a number of natural depressions in which water collects during showers, and "hard-pan" follows the disappearance of the water. This variety, usually one of the foremost, has suffered a reduced yield in consequence. Its average yield, however, during six years is practically 21 bushels. The paddock was last cropped in 1902, and during 1903 it was under grass, a very luxuriant growth having followed the wheat crop of the former year. This carried a large number of stock till ploughing was done.

The rainfall was not well distributed during the year, the months for land preparation, viz., February to May, inclusive, having received only 340 points. From January to May, inclusive, the total fall was 527 points. From the time of sowing Farmers' Friend and Darts' Imperial till they were cut, the rainfall was 978 points, the other varieties having received up to 97 points more.

The quantity received during September, one of the most critical periods during the growth of a wheat crop, was only 36 points, and it was, therefore, far short of requirements. The total rainfall for the year was 1,615 points.

The total area under wheat, exclusive of the lanes dividing the respective blocks, was 237 acres, comprising twenty-five varieties of wheat, with fifteen different methods of treatment, the average yield being 18⅕ bushels per acre. Of this area the tests, other than variety comparisons, occupied 127 acres.

Following are details of treatment and yields, which again show the superiority of drilling over broadcast sowing, while in all cases No. 1 grade seed showed substantial increases over lower grades.

The increased yields due to the use of manure are not as great as usual, but all are profitable.

COMPARISON of Varieties of Wheat.

All manured with 60lb. per acre No. 1 Superphosphate, costing 2s. 9d. per acre.

Name.	Yield per acre. bus.	lb.	Name.	Yield per acre. bus.	lb.
Federation	22	15	White Tuscan	17	30
Australian Talavera	20	57	Field Marshall	17	30
Darts' Imperial	20	26	Sussex	17	43
Jade	20	24	Schneider	17	4
White Essex	20	20	Hudson's Early Purple Straw	16	30
Zealand	20	11	Jonathan	16	28
Farmers' Friend	20	7	Marshall's No. 3	14	9
White Lammas	18	30	Cretan (Bearded Varieties.)	16	3
Cumberland	18	27	Farrers' Durum (Bearded Varieties.)	14	57
Bobs	18	11	Belotourka (Bearded Varieties.)	14	36
John Brown	17	58	Medeah (Bearded Varieties.)	12	48
Tardents' Blue	17	57	Kubanka (Bearded Varieties.)	10	9

With the exception of Dart's Imperial and Farmers' Friend, all were sown 17th to 28th May.

VARYING Quantities and Qualities of Seed.

Variety of Wheat.—Farmers' Friend.

Manure, 60lb. Bonephosphate per acre; cost 3s.

	lb. per acre.	Yield per acre. bus.	lb.
Seed No. 2 and 3 Grades	45	17	30
Do No. 1 Grade	20	18	31
Do ,,	40	20	0
Do ,,	60	19	12
Variety Zealand.			
Seed No. 1 Grade	30	19	42
Do ,,	40	20	11

DRILLED and Broadcast Seed.

Manure, 60lb. Bonephosphate per acre; cost 3s.

Seed, 40lb. per acre.

	bus.	lb.
Broadcast	16	31
Drilled	19	12

All the above test blocks, and Farmers' Friend in all cases, were sown from 2nd to 7th June.

*MANURE Test—Varieties of Manure.

Variety of Wheat.	Variety and Quantity of Manure	Cost of Manure per Acre s.	d.	Yield per Acre. bus.	lb.
Farmers' Friend	Bonephosphate, 60 lb.	3	0	19	12
	Nitro-super., 60 lb.	3	3	19	18
	Japanese Superphosphate, 60 lb.	2	9	19	56
	No. 1 Superphosphate, 60 lb.	2	9	20	7
	No manure	Nil.		16	45
	The above five blocks adjoined				
Bobs	No. 1 Superphosphate 60 lb.	2	9	18	11
	Japanese Superphosphate, 60 lb.	2	9	18	3
Hudson's Early Purple Straw	No. 1 Superphosphate, 60 lb.	2	9	16	30
	Japanese Superphosphate, 60 lb.	2	9	15	12
	Varying Quantities of Bonephosphate.				
Farmers' Friend	No manure	Nil.		16	45
	35 lb.	1	9	18	30
	60 lb.	3	0	19	12 and
				18	1

* Areas 5¼ acres to 12¾ acres, each running entire length of paddock, 46 chains.

Weeds of Bathurst District.

(Continued from page 628, Vol. XV.)

R. W. PEACOCK.

Black or Spear Thistle.

[Botanical name, *Carduus lanceolatus*, Lynn. Introduced from Europe.]

THIS belongs to the natural order Compositæ, and is one of the most widely distributed weeds. Its seeds are readily disseminated by winds, travelling stock, and other means. It frequents both cultivated and uncultivated lands and robs the soil of considerable amounts of moisture, taking the place of more profitable growths. In many places it makes an effective harbour for rabbits. This thistle thrives best upon the rich alluvial soils and is very partial to newly-ringbarked land, growing freely amongst the decayed vegetable matter around the dead trees. Very little can be stated in its favour, the most being that it is in some instances the pioneer of other vegetation, and that stock during droughts have been known to eat the seed heads, from which they apparently derived some benefit. Seeds germinate throughout the winter and spring, the plants producing large quantities of seed during the summer. Where comparatively few plants exist they can be eradicated by cutting them off below the crown of the root. When in large patches they should, wherever practicable, be cut with the mower before producing seed. Good farming eradicates them from cultivated areas. Figured in *Agricultural Gazette*, vol. 6, part 4, by Mr. J. H. Maiden, Government Botanist.

Star Thistle.

[Botanical name, *Centaurea calcitrapa*, Linn. Introduced from Europe.]

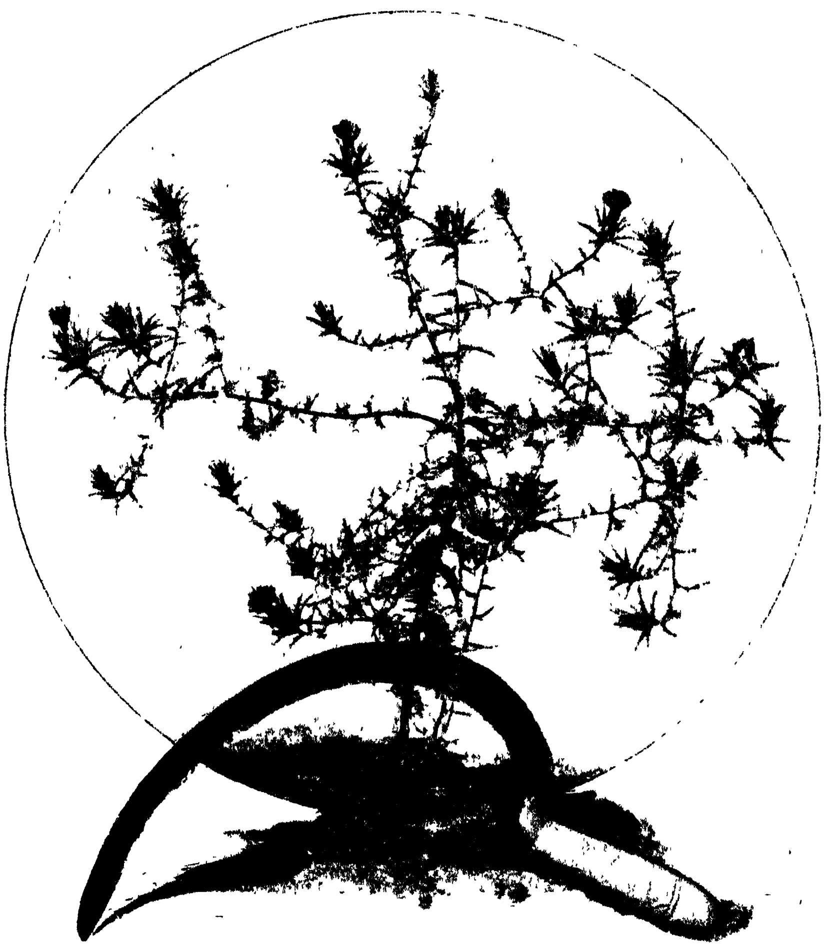
This weed has been plentiful throughout the district for many years. It is usually confined to waste places, roadsides, and grazing areas, and is not troublesome on cultivated lands. It often grows in large patches to the complete exclusion of other vegetation. This thistle has no redeeming qualities. After producing seed in the summer it dies, the old stems providing a harbour for rabbits and an admirable shelter for the countless young plants which come up during the winter and spring. Every effort should be made to prevent them seeding. It does not grow so high as the two former and has a more spreading habit. Figured in the *Agricultural Gazette*, vol. 5, part 7, by Mr. J. H. Maiden, Government Botanist.

Star Thistle.

Woolly or Saffron Thistle.

[Botanical name, *Kentrophyllum lanatum*, D.C. et Dub. Natural order Compositæ. Introduced from S. Europe.]

This is a comparatively new weed for the district and is at present spreading rapidly. In common with other thistles its seeds are distributed by winds. It possesses many of the characteristics of the black



Saffron Thistle.

thistle and is amenable to the same methods of extermination. It is a serious pest and land owners should use every endeavour to prevent its further distribution. Figured in *Agricultural Gazette*, vol. 5, by Mr. J. H. Maiden, Government Botanist.

(*To be continued.*)

Sheep Infested with the Larvæ of the Nasal Fly (*Œstrus ovis*) at Megalong.

WALTER W. FROGGATT.

DURING the early part of November last I visited Megalong and Gaylong in the Blue Mountains to see how far the well-known European sheep-fly was known over the district. From information received I believe that it was first noticed the season before in one flock of sheep. This year a settler has found from two to five well-developed nasal bots in the heads of the last five sheep he had killed, the sheep in question being hoggets in good condition. I obtained several fresh specimens of the larvæ, but was unable to keep them alive. As they were so large and apparently nearly full fed it is probable that they would have been ready to make their way out and pupate within a few months, as their life in the nasal cavities is about ten months, and the perfect fly would probably be about early in March.

The death of sheep in the Lithgow district from what was supposed to be nasal bot was reported about the same time, but I was unable to obtain specimens of the pest.

The occurrence of this pest in our flocks, though it may be more frequent than supposed, has been seldom reported. In this *Gazette* (Vol. XII, 1901), Mr. J. D. Stewart gave a general account of its habits and life history as known in England, and reported finding the bots in the head of a sheep upon which he was holding a *post-mortem* examination.

The fly, unlike the true bot flies, is viviparous, depositing not eggs but maggots inside the nostril of the sheep, which are furnished with segmental spines and hooks on the head, admirably adapted for progression through the soft tissue and along the mucous membrane, and make their way up into the frontal sinuses of the head, where they develop to the full size, and then crawl down into the nasal cavities, and are sneezed out by the unfortunate host. The larvæ hide in the ground for about a month, before the perfect fly comes forth.

As little or nothing is known about the fly or its life history in Australia, I should be very glad to obtain specimens from stock-owners of any bots or maggots found in the head of slaughtered sheep, or upon the ground, and of any fly found hovering round the sheep.

The Growing of Flax for Fibre and Seed.

RICHARD F. STRACHAN,
Taralga, late of Uralla.

I HAVE now for a considerable number of years been experimenting, with a view to introducing this very valuable plant in New South Wales, and I feel convinced that ere long flax-growing will be numbered amongst our leading industries. I will give the result of my experiences in the growing and preparing of flax for market.

Soil.

Any good black, grey, or chocolate soil which will grow a good crop of barley, wheat, or potatoes will grow flax—a soil and climate which will grow potatoes for choice. I may here mention that frost will do no appreciable harm to this plant.

Sowing.

March, April, and May I have found the best periods for sowing, as this gives the crop the full benefit of the spring weather. The land should be worked until thoroughly fine and level. Care should be taken to have this done properly, so that when sown at least two seeds to the square inch will germinate, otherwise, if the plants should spring up too far apart, they will "stool" out, which would considerably reduce the value of the fibre, as, instead of having a good, long fibre, it would be all in short lengths called "tow," and only worth about one-sixth of the price given for the full-length fibre. Sow the seed broadcast over the last stroke of the harrow and roll down flat; or, should it happen to be very dry, harrow the seed with very fine harrows, and roll down.. The best results are obtained from the former method. The seed will perish if covered too deep. At the rate of 60 lb. of seed per acre is the best quantity to sow for present Australian requirements, that is, both seed and fibre. In time, when spinning and weaving mills will be established, a much finer fibre will be required, and it will then be necessary to sow up to 100 lb. of seed to the acre; but fine fibre must always be grown at the expense of the seed yield, while not necessarily increasing the weight of the fibre obtained, only the quality would be better, other things being equal.

Harvesting.

No doubt the European method of "pulling" the flax will give the best results, where it is possible to do so. A good crop of flax could be pulled and stooked at the rate of, say, 25s. per acre, but the question of finding sufficient labour to do this, assuming that 200 or 300 acres were under cultivation, might prove a serious one. However, I was informed by Messrs. Miller & Co., rope and twine manufacturers, of Melbourne, who are, I think, the largest buyers of the fibre in Australia (I have not approached the Sydney firms as yet. Messrs. Miller & Co. absorb about 300 tons of the fibre per annum, worth about £16,000) that they are prepared to pay within a fraction of the same price for "cut" flax (cut with reaper and binder) as against "pulled," and with this knowledge no one need be afraid of the harvesting of a large area. Flax is the easiest crop to save in wet seasons because the fibre cannot spoil and the seed (linseed) will stand more rain than any other kind of grain before shelling out. The sheaves should be as small as a binder will tie, to facilitate threshing, and should be stooked in long rows to dry. The drying takes about three weeks on account of the oily nature of the plant. When dry, stack like any other crop. When threshing the crop the grower must bear in mind that the straw must not be torn about unnecessarily, or otherwise the fibre that is in the straw would be damaged. Only the heads of the plant should be subjected to this operation. The average yield of seed from a good crop would be about 14 bushels (56 lb. to the bushel), and the average price obtainable would be about £15 per ton. The next operation is the "retting" (corrupt form of "rotting"). This is the operation that has brought several, who have tried growing flax and prepared it after European methods, to grief. The European method is known as "water retting," but the most successful method I know of in Australia is "dew retting." The previous method, "water retting," is impossible in most places in Australia on account of the water, in most localities, being too hard and brackish, and, even where this is not the case, it would cost a great deal more, and the risk of spoiling the fibre is very much greater. "Dew retting" consists in spreading the "flax straw" in straight rows, about an inch thick, on a clean paddock (grass for preference, but stubble will do), and left for about three weeks, then by running long, light poles under it it is deftly turned over and again left for about another three weeks. The period varies according to whether the weather is moist or dry. The first opportunity of a few fine days must be taken to dry the now "retted straw," and it can now either be carted directly to the mill, or stored in a barn, or stacked outside and well thatched, pending a convenient time to extract the fibre. Any fine day will dry the "straw," if turned a day before, and when gathering it up gather as much as possible in the arms, and tie with binder twine round the bundle. But should the weather be unfavourable, gather it up in armfuls and stand it up in the shape of a sugar-loaf. This will prevent it spoiling in bad weather. Now comes the "breaking" and "scutching." The straw is now passed

through a "breaker," which is composed of two pair of fluted iron rollers. These rollers break the woody stem inside the fibre in little bits like chaff. From there it goes on to the "scutcher," which consists of rapidly-revolving wooden blades or beaters, which clean out all the broken-up woody stems and broken fibre, called "tow." It is now packed in bales and ready for market—the price obtained for fibre being from £40 per ton according to quality.

I have conducted my experiments on a small scale (5 acres being the largest area cultivated) at Urana, in Eastern Riverina, and was greatly hampered owing to the exceedingly dry seasons and having only a very small area of land; but I have no hesitation in saying that this industry would thrive well in any good dairying district where potatoes can be grown as a test of quality of soil and climate.

I would also point out that in the growing of this valuable plant for linseed alone there ought to be a good opening for some enterprising capitalist. The average return from a crop of flax grown for both fibre and seed is about £10 per acre clear of all expenses. The market is unlimited for this fibre; after supplying Australian requirements (which will alone absorb some thousands of pounds yearly) we have the home markets. Last year the shrinkage in the supply of flax there amounted to some 8,000 tons, quoting from a report which appeared in the *Argus*, Melbourne, some time ago: "The production of flax-growing countries in Europe has reached a stage that flax spinners in the United Kingdom are seriously concerned for the future. Russia, which has hitherto exported large quantities of flax to Great Britain, has fallen behind considerably. The Irish farmers, with their limited acreage, do not seem to be able to cope with the shortness of supply."

Woolly Aphis on Apples.

Mr. Geo. H. Willis, of Greenbank, Corowa, reports that pure water sprayed on to the diseased trees previous to spraying with kerosene emulsion has proved most effective against woolly aphis. Mr. Froggatt, Entomologist to the Department, concurs in this—the water helps to wash away the protective covering, enabling the kerosene emulsion to come in contact with the aphis and kill it.

Farmers' Fowls.

G. BRADSHAW.

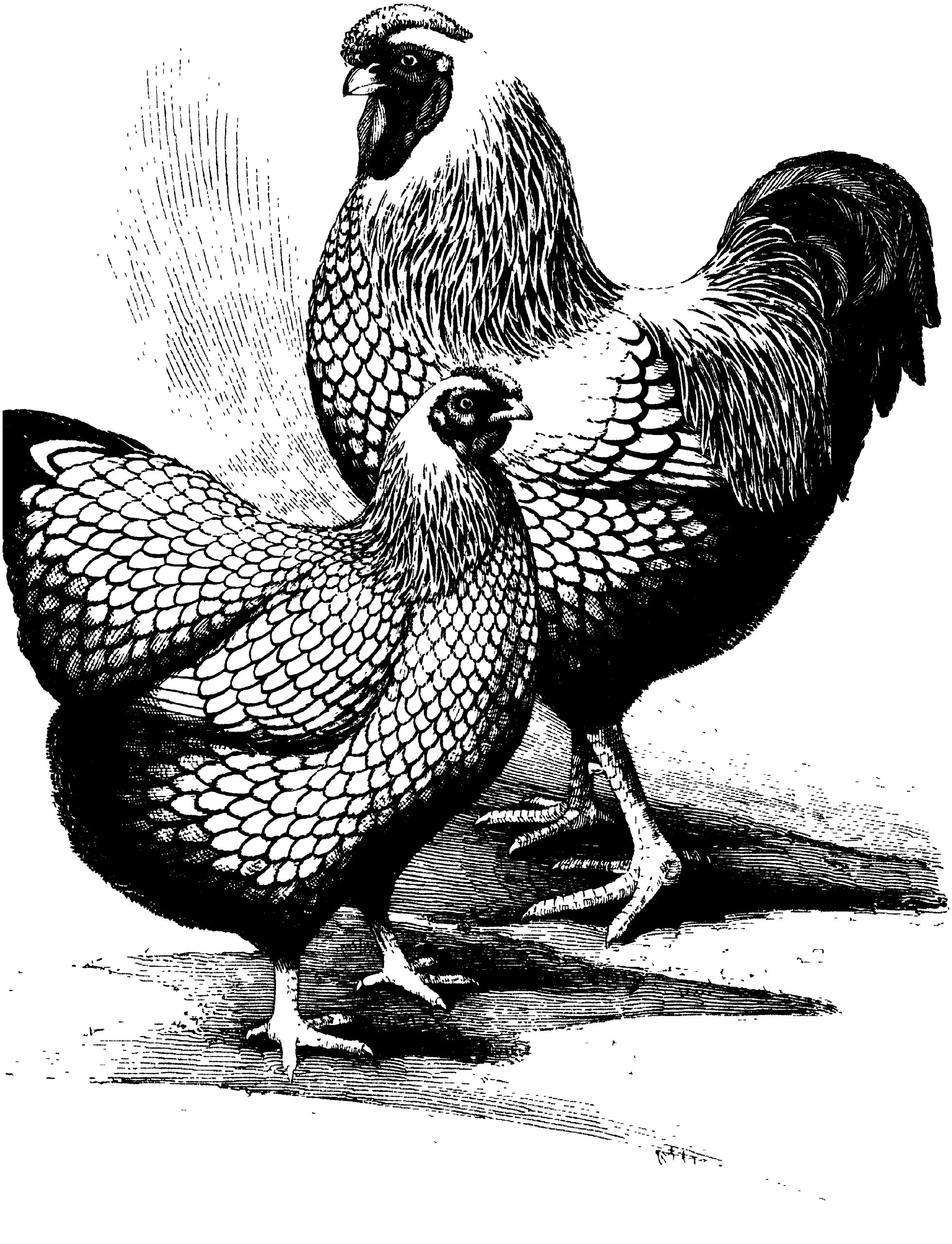
CHAPTER I.

Introduction.

WHEN, in 1897, I contributed a series of articles to the *Gazette* on "Profitable Poultry Breeding," and followed with what was intended to be monographs on all the popular breeds of fowls, increased duties at the Export Cold Stores obliged a temporary abandonment of the project, not, however, until the Orpington and Wyandotte breeds were exhaustively dealt with. How the works were received was evidenced by the fact that in a few months the several thousands of reprints were exhausted, and for several years there has been continuous requests for second editions of the respective pamphlets. Anconas have also been dealt with, and the intentions are still good for treating lengthily on all the breeds. However, the rate of progress has been so slow in the past, that to give the histories, adaptabilities, and other claims of the remaining breeds at the same rate of speed as was occupied with those mentioned, long before the last one would be reached other later originations would have appeared, hence no reasonable finality could be expected. To overcome the apparent difficulty of dealing with all, and giving undue preference to none, it has been suggested that as the Orpington and Wyandotte hold premier positions as to popularity, and new varieties of both have originated since the publication of the first articles, that a second series might be undertaken.

This, however, did not get over the difficulty of time, which has been satisfactorily solved by the editor, who, in place of the one-time twenty-five or thirty page contributions, has signified his willingness to accept half that number for each issue, the priority of breeds being as satisfactorily settled by the adoption of the simple title of "Farmers' Fowls"; and as the agricultural farm is the ideal home for domestic poultry, every known breed and variety can be embraced in the comprehensive title.

In the previous articles, under whatever name, it will be recollected that the chief subjects were the history of the various breeds and their adaptabilities, whether for eggs or meat, or both; the production of market fowls and eggs, marketing, storing, &c., &c. The present contributions are, however, intended to be more comprehensive, embracing every phase of poultry-keeping, including locality, appliances, runs, coops, breeds, crosses, artificial and natural incubation, feeding, rearing, diseases, fancy and market poultry, &c.; causes of failure and other disappointments in the industry.



TYPICAL SILVER WYANDOTTES.

The chief departures from the usual writings and teaching will be the absence of any desire to make the subject attractive by unduly magnifying the possibilities of the industry, a lengthened experience testifying to the fact that although some people are making a living from fowls alone, and many largely assisted by the profits resulting from poultry-keeping as a side issue, there are numerous instances, and some late ones too, where goodly sums have been lost in poultry ventures, and to assist in reducing the numbers of these annual failures will be one of the objects of these papers. No promise of a fortune will be held out to those contemplating an investment in the business, for just as with other stock, if correctly incepted in a small way, and intelligently managed, there will be satisfactory progress, and in the course of time a living will be made from it; and if carried on with fruit-growing, or other various issues of the farm, a success can be assured.

Big poultry establishments in this country are very few, and when they do occur they are like the big city businesses—they are not the growth of a day, but the result of small beginnings, a gradual annual growth, interrupted by many unpreventable losses; and when a successful and paying business has been established, the same care and management which contributed to the success has to be as diligently employed, and provision always to be made against possible bad years which every trade, business, profession, and industry experiences. The writer's desire will be to supply the information in as simple a manner as possible, the subject requiring neither scientific phrases nor fine writing to invest it with interest.

Before the close readers will have found some present-day theories and popular prejudices discarded, but whatever the innovations, such have been found by practical experience and recorded in the hope that the novice may derive some assistance in poultry-keeping, and the young fancier help in the way of producing form and feathers. A series of charts, tables, &c., eggs, foods, poultry, prices, &c., new to such works will be given, the whole calculated to show that the breeding of poultry, whether for eggs or meat, or both, is like that of any other business, viz., knowledge, experience, brains, and business methods are essential to, and, in some instances, command success.

Chapter II.

Glossary.

In connection with poultry-keeping and breeding, whether for egg-production, carcases for the market, or the fancy, which embraces exhibiting, &c., there are a large number of words and phrases, technical and other terms employed in connection therewith, some of them being quite unintelligible to the novice, and as a number of them may be used during the currency of these articles, the present will be the most suitable place to give a definition of such. The alphabetical order in which they appear making them handy for reference. The chapter on diseases will be reserved till the end of the work.

Addled Eggs.—An egg in which the germ has lived, but from some cause dies and the egg becomes putrid. The word is derived from *adel*, a disease.

Age of Eggs.—This can be fairly accurately told by their density, which decreases as they become older. If 4 oz. of common salt is dissolved in 1¾ pints of water, and a new-laid egg be put into the liquid, it will sink to the bottom. An egg one day old will scarcely touch the bottom, and as the age increases the more will it rise.

Air-cell.—The bubble at the thick end of an egg which supplies the chick with air during incubation. The slightest perforation of the air-cell will prevent hatching.

Allantous.—A bag or sack which develops during hatching, gradually extending until it surrounds the chicken close to the shell, and furnished with a net-work of blood-vessels, and serves as a temporary lung until the chicken is hatched.

Analyses.—The splitting up of foods or other substances into their component parts.

Animal Food.—Is a substitute for the worms and insect life which fowls get in a natural state. Flesh of any animal, cooked or raw, green cut bone, dried blood, or meat meal.

Albumin.—A group of compounds, soluble in water, coagulated by heat. The white of an egg is the chief of this class, and nearly pure.

Artificial Incubation.—The hatching of chickens by any other means than bodily heat. The artificial heat being supplied by oil, gas, or other combustive substances.

Asiatics.—A family of fowls embracing Brahmas, Cochins, Malays, Langshans, and others, all of which lay brown eggs, and are sitters, *i.e.*, become broody.

Aylesbury.—A town in Buckinghamshire, which gives the name to the most popular breed of ducks bred in England.

Barn-door Fowls.—The usual nondescript fowls seen on or about a farm or holding. Sometimes known as dunghills, but more commonly mongrels.

Barred.—Stripes of dark and light across the feathers, as appears in Plymouth Rocks and others.

Balanced ration.—A diet of various foods so arranged or balanced as to get the proper balance of albumenoids and heat-producing foods calculated to give the best results.

Beard.—The muff or bunch of feathers under the throat of some breeds, such as Houdans, Polish, Faverolles, &c.

Breast.—In a dead fowl the under part where the bulk of and best meat is. In a live fowl the breast commences under the throat, and reaches to the keel or breast bone.

Breast-bone, Crooked.—A bend or twist in the bone, and usually formed when the bird is young, and due to various causes. A serious defect in Game fowls.

Breed.—Any variety of poultry presenting distinct characteristics in type and colour. Type, however, makes the breed, colour the variety, *i.e.*, all Plymouth Rocks should be the same type, whether they are white, buff, or barred.

Brood.—A clutch, flock, or family of chickens under the care of a hen.

Broody.—When a hen shows a desire to incubate she is termed broody or clucking.

Brooder.—An American term for an appliance used in the artificial rearing of chickens; known in England as a foster-mother.

Breeding in and in.—A system used by the most successful breeder to perpetuate certain traits of type, colour, or other characteristic.

Bone, Green cut.—Fresh bone cut into a fine form, and supplied to the fowls either mixed in the mash or given apart. It is rich in the essentials of egg-production.

Broilers.—Chickens from seven to ten weeks old, and favourite dishes in American hotels. They are split up the back and grilled, the whole bird making a dish for one.

Boned Fowls.—A system of removing every bone from the chicken or fowl, leaving the meat unbroken or torn. An art of the poulterer.

Carriage.—The shape, style, or altitude of a fowl.

Capon.—A male bird deprived of its generative organs, the weight and delicacy being improved thereby.

Caruncles.—Fleshy protuberances to be seen on the head and neck of Muscovy ducks and turkeys.

Chick.—The young of a bird, particularly of a hen, and only applies to a few days old.

Chickens.—In America domestic fowls of any age are termed chickens, *i.e.*, the chicken industry, the chicken market, In England and Australia applied to those weeks or at most a few months old.

Chipped.—An egg is said to be chipped when the young cracks the shell.

Cockerel.—A young cock known as such when under twelve months old.

Comb.—The red protuberance on the top of the male bird's head, taking several forms, such as, single rose, and others.

Condition.—A term usually used in connection with exhibition poultry, referring to beauty of plumage, health.

Crop or Craw.—The bag where the food is stored before it passes to the gizzard to be digested.

Cross-bred.—The progeny from two pure breeds, and when naming the cross that of the male bird is mentioned first. Birds bred from a Brahma cock and Dorking hen are called Brahma-Dorkings, while from a Dorking cock and Brahma hens they are Dorking-Brahmas.

Common Fowls.—The ordinary barn-yard fowls as apart from pure breeds.

Cramming.—A system of artificially feeding young fowls, either by hand or machine, for the purpose of putting on extra flesh, three weeks being the usual course.

Carbo-hydrates.—A food constituent,—starch, sugar, and gum being the leading constituents, -and supplies heat and energy.

Canned Eggs.—A system of egg-preservation in America. The yolks and whites are separated and canned in the same way as meat or vegetables, and in this form are mostly used by cooks and confectioners. The shells are broken up and sold as fertilisers.

Cold Storage.—A system of holding over eggs from a cheap until a dear time, the advantages of the system being the absence of any preservative.

Colour-feeding.—A modern innovation in the poultry world following the boom in buff fowls. The craze for rich colour prompted the administering of cayenne and other pigments during moulting time. A well-known English writer has stated that he knew of many birds too light in colour which were converted into prize winners by colour-feeding.

Crest.—A bunch of feathers on the top of a fowl's head, as the Polish, Houdan, and others.

Cushion.—The rise or mass of feathers on the tail end of a hen's back, largely developed in Brahmas and Cochins.

Chalaze.—Two slightly opaque and twisted cords of dense albumen attached to the yolk and white, and acts as a balancing weight to keep the side of the yolk which carries the germ uppermost.

Deaf-ears.—The skin below the fowl's ears. They are red in the Asiatics, and white in the Mediterranean breeds.

Dubbing.—The removal of the comb, ear-lobes, and wattles, thus leaving the head lean and thin looking.

Dead in Shell.—An egg may be fertile, and the germ develop, but may from lack of strength die at any stage up to the twenty-first day.

Duck-footed.—When a fowl has the hinder toe turned in it is so called, and is a great demerit in Game.

Down.—The finest feathers on ducks, geese, and swans.

Double Mating.—The mating of two different pens of the same breed, the one to produce standard coloured cockerels, and the other to produce pullets of exhibition colour.

Egg-bound.—See Diseases.

Egg-candling.—A system of testing eggs as to quality and soundness, by holding before a strong light in a dark room. Any that show a dark spot, or other trace of unsoundness, being discarded.

Egg-testing.—This is done the fourth or fifth day of incubation, by carefully examining each egg before a strong light. Those that have undergone no change being infertile, and may be removed.

Egg-cooling.—When hatching with incubators cooling for, say, 20 minutes twice daily is essential to a successful hatching, and corresponds with the daily leave the hen takes from her nest.

Egg-turning.—This is usually done twice a day, and in imitation of the hen, who frequently turns her eggs during incubation.

Egg-preserving.—The use or application of vaseline, waterglass, or other substance to prevent decay, and hold the eggs for a rise in market, or other purpose.

Fresh Blood.—The introduction of birds from other yards to increase vigour, or improve the appearance of a flock of fowls, to counteract the effect of inbreeding.

Foreign Eggs.—All the eggs imported into the United Kingdom, from whatever country, are called foreign eggs. These now amount to over six million pounds sterling annually.

Female Influence.—The hen usually influences the internal and vital organs, hence, if a good layer, her progeny may reasonably be expected to be good layers also. There are, however, many exceptions.

Faking.—The trimming, plucking, colouring, or otherwise changing the natural appearance of a fowl, in order to assist it in securing a prize.

Face.—The bare skin round the eyes of a fowl.

Fancy Points.—The breeding for feather, type, and other peculiarities, as apart from economical purposes.

Flights.—The long wing-feathers, called primaries, and used only when flying. They are kept tucked up under the wing.

Feather-eating.—A habit acquired by fowls kept in confinement, idleness usually being the cause.

Fattening.—Feeding fowls liberally to put on an extra quantity of flesh preparatory to killing.

Fluff.—The soft, downy feathers about the thighs of fowls, particularly Brahmas and Cochins.

Furnished.—When a male bird has assumed his full plumage he is known as furnished.

Favus.—A comb disease.

Fatal Defect.—A term applied to features in exhibition poultry which disqualifies them from getting a prize. White feathers in a black fowl, or *vice versâ*. The want of the fifth toe in Dorkings, or the presence of such in a number of other breeds, being an example.

Gapes.—An affection of chickens, due to the presence of worms in the throat. Not prevalent in Australia.

Gout.—Distinct from leg-weakness, by the swelling of joints suddenly.

Germ.—A small disc resting on the top of the yolk, and known as the blastoderm, from which the chicken is developed.

Gargle.—A disease in geese, often fatal among goslings.

Gills.—Sometimes called wattles. The pendulous red skin appendage below the beak, developed largely in the Mediterranean breeds.

Glaire.—The white of an egg—the albumen.

Green Goose.—An English term for a midsummer gosling which has been principally fed on grass. Another cause for the name is that it is young, *i.e.*, green.

Game Fowls.—The well-known group of fowls, hard in feather, of many colours, and celebrated for fighting propeties.

Grit.—Material such as small stones, broken glass or crockery, shells, and other material eaten by the fowls to grind their food, *i.e.*, fowls' teeth.

Green Food.—Grass, cabbage, lettuce, or other succulent herbage necessary for fowls when penned up, and deprived of their natural food.

Hackle.—The narrow feathers on the neck of a full-plumaged cock. The same sort are found on other parts of the body, and called back and saddle feathers.

Hatching—The incubation of eggs by any means.

Henny Game.—A variety of Game fowls, the male bird being feathered like a hen, having no sickles.

Hen-tailed.—Males with tails like hens, as in the Seabright bantams.

Higgler.—A travelling poultry buyer, who collects for the buyers in Norfolk, Sussex, and Kent, so named by reason of haggling or wrangling over his dealings.

Hen-wife.—A woman who takes care of poultry.

Hovers.—When a hen covers her chickens she is said to hover them,

Hard-feathered.—Game fowls of whatever sort are usually called the hard-feathered varieties.

Hereditary.—Many diseases are hereditary, while defects, such as squirrel tails, crooked backs, &c., are frequently inherited.

Hospital.—Quarters on a poultry farm wherein to isolate and doctor sick poultry.

Hydro Incubator. Incubators whose heat supply is kept up by drawing a quantity of the water away from the tank and supplying its place with some of a higher temperature.

Hybrid.—A cross between domestic fowls and pheasants, &c.

In-breeding.—The breeding together of closely related stock.

Incubation.—The hatching of chickens by whatever means.

Indian Corn.—Maize, a much-used grain for fowls of fattening tendency.

Indian Game. — Well-known fowls, of erratic nomenclature, being of Cornish origin.

Infertile.—A term employed to eggs which have not been fertilised by the male bird.

Influence of Male.—The power of the male bird to implant certain characteristics in his progeny. Prepotency.

Insect Food.—The grubs, worms, spiders, and other life which fowls find when on a free range, a substitute having to be supplied when kept in small runs.

Indian Runner.—A rather small duck, of peculiar build ; prolific layers.

Indigestion.—The effect of which is a disinclination for food. See Diseases.

Inflammation.—Frequently brought about by a chill, weakly fowls being most subject to it.

Inheritance.—The likeness inherited from the parents, whether of form, feather, or other feature.

Judging.—The comparison of one bird with another in poultry shows, to determine which have the desired qualities in the greatest proportion.

Joint Disease.—A disease apart from leg-weakness and gout, and incurable.

Jersey Blue.—A fowl of American origin. Its dark legs, however, interfere with its becoming popular. They are of a slaty-blue plumage.

Keel.—Known as the breast-bone, and reaching vertically from the breast in front to the stern. Deep and long is desirable, being then capable of carrying greater quantities of meat.

Killing.—This is done in various ways, breaking the neck and bleeding being the most general.

Knock-kneed.—The hocks being close together instead of well apart.

Legs.—That portion extending from the hock to the foot, and covered with scales. In a table bird the leg is the portion above the hock-joint.

Leg Feathers. — The feathers extending down the outer sides of the legs of the Asiatic breeds.

Leg-weakness.—Young birds of the heavy varieties are frequently troubled with this. If allowed to continue the joint becomes stiff and the toes curled up. There are various causes.

Legs, Scaly. There are two forms of this disease. The one due to the presence of a small insect, and contagious. The other from a deficiency of oily secretion, causing the scales to dry up and the skin to split.

Lacing. The edging all round a feather of a different colour, as in the Silver and Gold Wyandotte, Polish, &c.

Laying Breeds. — Leghorns, Andalusians, Minorcas, Spanish, and Anconas are usually known as the laying breeds.

Line Breeding. —A form of scientific in-breeding, the object being to secure and establish certain features in the posterity.

Lobes.—The small skin under the fowl's ear, of round or oval shape. In the Asiatic breeds and their crosses it is red, while in the Mediterranean and Hamburgs it should be pure white.

Liver Disease.—Highly fed poultry in small yards, and denied fresh green food, are subject to hypertrophy or enlargement of the liver. Severe cases are incurable.

Mossy.—Confused, peppery, indistinct appearance in feathers that should be white or other colour.

Marking.—Denoting the colours and peculiarities of fowls according to breed.

Mating.—The selecting of male and female birds to form a breeding-pen.

Manure.—Fowl droppings have a special value in most other countries than Australia as manure. There is a difficulty in its disposal here.

Mallard.—The wild or black duck.

Mash.—The mixture of bran, pollard, and other meals, usually supplied as the morning meal.

Malt Culms.—Sometimes known here as germs, but actually malt sprouts. They have valuable digestive properties, and are rich in fat.

Muff.—A bunch or tuft of feathers under the beak as seen in Houdans, Faverolles, and Polish.

Middlings.—Known also as sharps, pollard, a by-product of wheat and a popular feeding meal.

Moisture.—A term applied in the working of incubators, too little or too much affecting for ill the results.

Musk Ducks. — The well-known Muscovies, a variety not commonly bred outside New South Wales.

Moulting.—The annual dropping of the feathers to make room for the new ones. From the Latin signifying to change.

Mediterranean Breeds.—Anconas, Spanish, Leghorns, Andalusians, Minorcas, all layers of large white eggs, and non-broody.

Modern Game.—The Exhibition or British Game. The chief considerations being colour, hardness of feathers, and length of limb, otherwise known as reach.

Mongrels.—The ordinary fowls seen in city, country, and suburbs, as apart from pure breeds or crosses.

Moubray.—A celebrated writer on poultry about one hundred years ago.

Nest Eggs.—A China or other egg left in the nest as an inducement to the hen to lay.

Neve Crammer.—A modified labour-saving cramming machine on improved principles from the earlier makes of this article.

Negro Fowls.—Another name for the silky fowls, so called from their black skin and bones.

Norfolk Turkeys.—A large black turkey with a few white spots on wing, usually called Norfolk blacks.

Open Judging.—The judging at poultry shows of old was done with closed doors. The demands of exhibitors to get such done in view of the patrons is now largely adopted, and termed open judging.

Ovary.—The cluster of small or rudimentary eggs, resembling a bunch of fruit, found in most adult hens.

Oviduct.—The funnel-shaped egg passage into which the yolk and germ are liberated, and then gets clothed with the white and other element for its development.

Over-crowding.—The keeping of too large a number of fowls in a limited space, thus prompting disease.

Oats.—The best cereal food for laying hens, used more largely in England than this country.

Oatmeal.—In the absence of the prepared foods one of the best foods for young chickens.

Ossifine.—A Sydney preparation of fresh bone in a dry form. A substitute for green cut bone, with better keeping qualities.

Pedigree Breeding.—The breeding of fowls in a scientific manner, as is done with cattle and other stock.

Pullet.—A female fowl in its first year.

Plumage.—The feathering or plume of a fowl.

Poultry-farming.—The keeping of poultry solely as a means of living as distinct from fowls on a farm, where they are but an auxiliary.

Poultry Clubs.—Organisations or societies whose objects are the advancement of poultry-culture.

Portable Houses.—A variety of poultry-houses on wheels, largely used in England, purposed to be removed at intervals on to fresh ground.

Points.—The standards for judging fowls apportions the various sections of the birds into points, the total of which number 100, the purpose being as a guide to judging.

Poulardes.—A pullet deprived of the power of producing eggs, with the object of great size.

Pekins.—The well-known canary-plumaged duck, largely bred on the American mammoth duck farms.

Pin Feathers.—Sometimes known as stubs. The small rudimentary feathers remaining on young fowls or ducklings after plucking, only seen on adult fowls at moulting time.

Prize Poultry.—Pure-bred or fancy poultry whose high breeding entitles them to prizes in a show, but a small proportion of pure-bred poultry are prize poultry.

Partlette.—A name given to a hen with a ruff on neck, a neck apparel worn by ladies in 1600.

Partlette Dame.—A bearded or whiskered hen was so called.

Pea Comb.—The peculiar comb of the Brahma, resembling three combs crushed into one—a triple comb.

Primaries.—The outer flight feathers of the wings, and with which the fowls fly, kept tucked up under the secondaries. The colour of these is important in several breeds when being judged.

Parasites.—The almost numberless sorts of vermin which live on or in fowls. See Diseases.

Pip.—A hard substance on the tongue of a fowl. Not a disease, but the result of disease, analogous to a foul tongue in human beings.

Pulter.—A royal officer who had charge of or to see that the royal household was properly supplied with poultry. The London City Company of Poulterers is still spelt as Pulters Company.

Pheasant Fowls.—Applied in Yorkshire and Lancashire to the coloured Hamburg.

Proteids.—A name given to several constituents of food, as albumen, casein, &c.

Preservation of Eggs.—The application of some coating or element by which eggs can be held over a long time, and retain their food value.

Pencilling.—The crescent-like markings on the feathers of Dark Brahmas, Partridge Cochins, and Partridge Wyandottes. On Hamburgs this peculiarity runs straight across the feathers.

Poult.—A turkey in its first year.

Post-mortem.—The dissecting of fowls, with the object of determining the cause of death.

Prepotency.—The power of the male bird to impress his characteristics on his progeny.

Quantity of Food.—It is impossible to feed fowls by quantity or measure. Breeds differ in their consumption, and the same fowl eats more at one season than at another.

Quality of Eggs.—Northerns, souths, railway, and new laids are Sydney terms for eggs, each having a special quotation, and largely resulting from the age of the eggs, this being assumed from its source of supply.

Rust in Wing.—A reddish-brown colour which frequently appears on the wings of Brown Leghorns—a defect.

Rough in Face.—A term to describe the rough appearance which some Spanish fowls acquire, known as cauliflower face.

Rose-comb.—The well-known broad comb of the Hamburg family, and modified in the Wyandottes.

Repletion.—Some birds over-eat themselves, and move about after in a dejected manner, which is usually the forerunner of disease.

Reversion.—A term used by breeders to describe the occasional throw-back by pure-bred fowls to some original ancestor of, possibly, foreign colour or type.

Roup, Rheumatism, &c.—See Diseases.

Ripening.—The fattening of fowls by artificial feeding. After the usual three weeks' treatment the birds begin to go off, and are then called over-ripe.

Runs.—The usual enclosed spaces in which fowls are kept and bred. When such are of limited extent, and overcrowding takes place, disease assuredly appears. Clean earth, grass, water, and gravel are essentials to health.

Saddle.—That part of the back of a cock reaching to the tail, and covered with sickle-like feathers.

Side-hangers. — The shorter sickle-like feathers on each side of the cock's tail.

Squirrel Tail.—The carrying of the male bird's tail over his back, sometimes touching his head.

Scrabbed Eggs.—A Lenten dish, composed of eggs boiled hard, chopped and mixed with a seasoning of butter, pepper, and salt.

Shaping.—A system in Sussex and other English counties of placing the killed fowls in a V-shaped wooden gutter made of two boards. Weights are placed on the fowls, the object being to give them a more meaty appearance.

Shelter. — In England a shelter-shed is essential to keep off the rain and other inclemencies. In Australia the shed is still more essential, but for an opposite purpose—to keep off the sun.

Secondaries.—The quill feathers of the wings which cover the primaries.

Setting.—The usual dozen or thirteen eggs put under a hen for hatching.

Stag.—A name used for a young cock or turkey.

Spatch Cock.—A term scarcely known in Australia, applied in olden times to a hurried poultry dish. An abbreviation of dispatch.

Sickles.—The long curved feathers of a cock's tail.

Spur.—The offensive sharp weapon on the inside of the legs of adult cocks.

Spangling.—A spot or marking on the end of a feather, best seen in the Silver-spangled Hamburgs.

Slipped Wing.—Frequently the primaries, through some weakness, drop down, appear unsightly, and a great defect in exhibition fowls.

Sex of Eggs.—There are yet some people who profess to be able to tell whether a male or a female will hatch from certain eggs. Every such claim, when put to a practical test, has been disproved. The sex problem, in all life, remains a mystery.

Side Sprigs.—In even the best-bred single-comb birds at times sprigs start from the sides of the combs, which is a serious defect for show purposes.

Spring Chickens.—A term not much employed in Australia. In England the small chicken offered in April and May, and so termed. They realise good prices.

Self Colours.—A one or whole coloured bird.

Shaft.—The thin stem or quill of a feather.

Sharps.—Another name or grade of pollard.

Shank.—That portion of the legs where the scales grow.

Straw Colour.—White fowls, when exposed to the sun, frequently get what is known as a straw colour. This, in most breeds, is a handicap in the show-pen, but in Faverolles is the correct colour for cock's hackle, back, and saddle.

Strain.—A family of fowls possessing some feature in form, feather, or other peculiarity which is transmitted to the progeny.

Standard.—A scale or table of the requirements in shape and colour for the various breeds of poultry.

Symmetry.—Perfection of the various sections of a fowl as distinct from carriage.

Sussex Fowls.—A variety of fowls largely grown in Sussex, of no certain breed, and a variety of colours, but chiefly large-bodied and good market fowls.

Sussex Fowls (dead).—A well-known Leadenhall market term, not necessarily from Sussex, in fact sometimes from Ireland, but specially fattened.

Stolen Nest.—On farms or other places where fowls have a free run they frequently select a secluded laying-place, unknown to the owner, such being called stolen nests.

Soft Eggs.—The shelless egg occasionally found in poultry yards, usually attributed to lack of shell-forming material, but usually the result of the hens being too fat or having ovarian troubles.

Table Poultry.—Fowls bred for, or suitable for breeding market poultry, *i.e.* the table.

Tail Feathers.—The strong stiff feathers of the cock and hen.

Tail Coverts.—The soft curved feathers which cover the tail on both sides. The two top feathers are usually called sickles.

Thighs.—The joint above the knees, and usually covered with feathers.

Tom.—A name given in some English countries to the domestic cock, and in others to the male turkey.

Top Knot.—The bunch of feathers or crest on the top of a fowl's head, as in Polish, Houdans, and others.

Trimming.—The cutting or drawing out of feathers, or other manipulation of a fowl, with the object of improving its chances of winning a prize.

Trussing.—The manner of preparing fowls for roasting, boiling, or grilling, a different system obtaining for each way of cooking.

Tonic.—A medicine whose purport is to give strength and vigour and increase the appetite.

Trio.—A cock or cockerel and two hens or pullets.

Type.—The shape and symmetry of the various breeds of fowls.

Thumb-marked.—A mark or indention frequently appearing on the side of the comb of Leghorn fowls—a defect in the show-pen.

Unfertile, Infertile.—Non-productive. A barren or clear egg.

Undercolour.—The colour of the fowl underneath the surface.

Useful Qualities.—The qualities in fowls which contribute to their profitableness as apart from their appearance.

Variation.—The tendency to reversion or throwing back, well-known to prize poultry breeders.

Variety Classes. — These are for miscellaneous breeds of fowls, which are not provided for in the regular classification.

Vertigo.—An ailment betokening overfeeding to a great extent. A bird so affected will stagger about in a circle.

Vulture Hocks.—Stiff feathers projecting from the hock joints, as seen in Brahma fowls.

Ventilation.—A neglected but most important subject in poultry-house construction. As a rule they are either too draughty or under-ventilated.

Vermin.—Applies to the several sorts of body and feather-eating insects on a fowl, also to those found in nests, houses, &c.

Wasters.—Applied by fanciers to specimens not of sufficient merit to exhibit; culls.

Wattles.—Part of the adornment of the head of the cock, the thin, red, vascular appendage below the beak.

White Comb.—A white, scaly eruption of the comb, named Favus. See Diseases.

Web.—The thin structure of a feather on each side of the stem. Also applied to the skin between the toes of ducks.

Wing Bar.—A band of dark colour across the wing, seen in most parti-coloured fowls.

Wing Butts.—The shoulder of the wing, sometimes called shoulder butts.

Wing Coverts.—The feathers covering the secondaries.

Wings Slipped.—Of frequent occurrence in the Asiatic breeds. The primary feathers appear loose, and hang down below the secondaries; more general in cockerels.

White in Lobe.—In red-lobed birds, such as the Asiatics and Orpingtons and others, white is of occasional occurrence in the red; a defect in the show-pen.

Worms.—Appear in most fowls, and are the cause of a vast number of deaths in chickens.

Wry Tail.—A deformity said to be due to spinal causes; a serious defect.

Whiskers or Beard.—The muff of feathers underneath the beak in Polish, Houdan, Favorelles, and other French breeds.

Waterglass.—Silicate of soda, largely used of late years as an egg preservative.

Wyandotte.—A farmer's fowl, of American origin, whose history will appear in next issue of the *Gazette*, a typical pair of them illustrating this article.

(*To be continued.*)

A New Potato.

Solanum Commersoni.

CLAUD BRUN in *Le Petit Marseillais*, January 1st, 1905.

The Uruguay Potato: Its introduction into France; First Trials: Its improvements, its varieties, its production, its edible value.

ABOUT a year ago, when *Le Petit Marseillais* was the first to publish an account of the trials carried on at the Borely Park Botanical Garden in connection with the water potato of Uruguay, or *Solanum Commersoni*, we were far from suspecting the high-feeding value of the new tuber. But the trials which have been conducted with the plant since 1891 have confirmed the interest which it had already aroused.

It originally came from the marshy shores of Uruguay, and was introduced into Marseilles by the learned Professor Heckel. From the first it has been well known as a valuable fodder for growing in marshy grounds.

The tubers obtained from the trial plot were not palatable on account of their excessive bitterness, and it is owing to the experiments of M. Labergerie, landowner, of Verrieres, in La Vienne, that we have a new potato which possesses truly luscious qualities.

M. Labergerie, having received a few sets from our friend M. Vincent Davin, the enthusiastic fellow-labourer of M. Heckel, planted them in some damp soil, in La Vienne, and conceived the idea that by careful selection, and despite the difference of climate, they could be considerably modified, and their unpleasant taste removed.

The experiment was crowned with success, and at a conference of the Botanical and Horticultural Society, Dr. Heckel clearly showed the diverse variations of which the plant was capable.

The original type modifies itself rapidly: and in 1904 no less than one-third of the crop showed signs of a marked transformation. The results have wonderfully increased, even amounting to 27,000 kilos per hectare (or at the rate of 10·71 tons per acre), the yield varying according to the soil and the age of the plantation.

Among the variations seen this year, it is convenient to note a new violet variety (which is covered with lenticels), three yellow varieties, and two white ones. All these have a characteristic resistance to cryptogamic diseases superior to the original type which surrounded them, and which had not manifested any tendency to improve.

The first tubers, which were small and wrinkled, were planted in a cold, fertile soil, where they germinated well. In July two tubers of the violet variety emerged from the level of the ground, close to the

stock tuber. When cooked they were found good, although a little bitter. The product of the other plants was similar to the original type of *Solanum Commersoni.*

In 1902 M. Labergerie had twelve plants. In 1903, 120 plants produced the equivalent of 55,000 kilos per hectare (or at the rate of 21·82 tons per acre). In 1904 the division, eye by eye, of these tubers yielded 11,500 sets, and the crop was estimated at about 100,000 kilos per hectare (or 39·67 tons per acre). At the same time, the plant had improved in earliness of maturity, and single tubers exceeded 1,600 grammes (or 3½lbs.) in weight, while the tops attained a length of 4½ metres (or 14·76 feet).

M. Labergerie states that the flavour of the violet *Solanum Commersoni* is absolutely irreproachable: certain people find it superior to the common table variety, while others consider it at least equal to it. It possesses a faint perfume, and is easily distinguished from the common European article by the following characteristics: In the raw state the tubers are not bitter; after germination the taste is the same as before; when cooked and allowed to cool, there is no trace of soapiness. In short, the new potato possesses vast possibilities in damp, cold soils. This is certainly an excellent result to be arrived at, and Dr. Heckel's success, as we have said in a preceding article, has been of signal service to our agriculturists.

Dr. Heckel intends to try the newcomer in the damp soils of a few parts of Camargue. He hopes to succeed, and we can easily foretell the agricultural transformation which would be effected by it among the desolate flats of the Rhone. Of especial value is the fact that so many of the varieties have a great resistance to cryptogamic diseases, in fact their immunity is complete, which does not always happen with the kinds which have been so long in cultivation.

Varieties of the Solanum Commersoni.

From the *Bulletin des Séances de la Société Nationale d'Agriculture.*

The *Solanum Commersoni* is a native of the Mercedes River district (Uruguay). It is identical with the *Solanum Ohrondii* introduced into Europe as long ago as 1822.

Appearance.—The stalks are small and slender, similar to those of the potato. Flowers are very numerous; of a pale violet hue, extremely odorous, with a perfume like the jasmine. It is a creeper, and puts forth shoots and tubers in all directions. After it is first planted it perpetuates itself by the fragments of its roots.

Tubers.—White, with skin of a reddish yellow. It is improved by cultivation, and the skin becomes paler, silkier, and finer. The fleshy substance is generally yellow; sometimes greenish; taking this latter hue when cooking. The flavour at first is strong and bitter; but since 1901 this has been much improved, in a proportion varying with the age of the plants. The roughness of the skin, and abundance of the knots or warts, and their prominence, are generally proportionate to the bitterness of the flavour; but they are not an

absolute indication, and a tuber with a thin skin is often as bitter as a rough one. In spite of their bitter flavour, animals like them very well, especially when cooked. They have a great density, and their richness in fecula is very considerable. From the eyes, sprout shoots, generally fine and white, frequently at the end of the tuber, and very often several from the same eye. The smoothest skinned tubers have usually the largest shoots. The tubers are often joined by radicular filaments in the form of chaplets or wreaths.

Diseases.—In 1901 and 1902, both wet years, no trace of any disease was found on the *Solanum Commersoni*, whilst other varieties of potatoes were all badly attacked. This immunity also applies to the potato blight. In 1903, cryptogamic diseases caused terrible havoc in the Western districts. The *Solanum* was badly attacked in the leafy parts, between June 30 and July 10, most lightly in poor, silicious soil. Treatment with Bordeaux mixture arrested the progress of the disease, but a preventive treatment would certainly have hindered its appearance.

Temperature.—Since 1901 no plantation has suffered from frost. In 1903, between April 20 and 25, the temperature fell to 7° (*probably Reaumur*), but this only slightly retarded the growth of the young shoots.

Cultivation and Crop.—Planting took place at the end of March, and the crop is improved by planting in furrows. The plants should be from 20 to 25 centimetres apart. The superabundant vegetation suffices, with one working, to destroy all the plant parasites. The seed, once planted, lasts indefinitely; the land does not require fresh planting. The crop is gathered when the early frosts arrest vegetation. Harvesting is a little more difficult than with ordinary potatoes, because the tubers form and spread in all directions.

Manures and Fertilisers.—Plantations formed in 1901-2 and 1903 have received neither improvements, manure, or fresh planting since. That done in 1903, in poor soil, received at the time an application of 660 lb. of superphosphates and 220 lb. of chloride of potassium to the hectare (2½ acres).

Crops.—1. In fertile soil,—humid, clayey, calcareous, very rich in humus, of which half was invaded by the roots of trees, shrubs, &c., and bordering on a stream.

	Crop in 1901. Kilos to the Hectare.	1902. Kilos to the Hectare.	1903. Kilos to the Hectare.
Planted in 1901 ...	8,000	16,000	12,500
„ 1902 ...	—	17,000	12,800
„ 1903 ...	—	—	12,200

Some tubers planted in the same soil, but completely shaded by trees from the sun, only yielded a crop equalling 6,000 kilos per hectare (6 tons per 2½ acres).

2. In poor clayey soil where silicates predominated, half of which was watered by the soakage from a small brook; this worthless land bore, in 1902, under a little manure, a crop of artichokes, and in 1903, without any care or improvement, a second crop. In spring, 1903,

a single light working preceded the planting of *Solanum Commersoni* in furrows. Two ploughings would not have been sufficient to destroy the wild plants and artichokes, but other more important work intervened, and the *Solanums* were left to themselves. In spite of these unfavourable circumstances the crop per nectare yielded 8,500 kilogrammes; while previously, on the same ground, 3,000 and 3,500 kilogrammes per hectare of potatoes were obtainad.

Acclimatisation.—The *Solanum Commersoni* only appears to become acclimatised by the second year. The size, appearance, and flavour of the tubers are considerably improved in the older plantations.

Description of Soils.—Humid, marshy soils suit the *Solanum Commersoni.* The richness in lime or silicates so far appears to have no effect on either the vegetation or flavour.

Value—Alimentary, Commercial, and Agricultural.—Stalks: These are liked by horses, asses, and goats, but their consumption destroys the tubers, and probably the flowers. The flowering commences about a month after the tubers sprout, and continues until vegetation is finished. The flowers exhale an intense perfume, similar to jasmine. An experimental extraction of the perfume gave an exquisite odour, aromatic, and very lasting. Those plants deprived of their flowers furnish a perfume in no wise inferior to others. Fruit: This contains a perfume similar to that of the flowers, but very intense. In one case it was so strong that the place was rendered uninhabitable for about fifteen days, while the fruit experimented on was being exposed to a current of warm air.

Tubers.—Too bitter as a rule for human consumption, but they are rapidly improving in this respect. They are much liked by animals, especially after cooking, and they will form a valuable resource. Their richness in fecula is very great.

To conclude, the *Solanum Commersoni* is well worth attention. First, as an alimentary plant, well adapted to damp and marshy soils. Secondly, it has various industrial properties (for factories, etc.). Thirdly, it is an excellent fodder plant; and fourthly, it provides an exquisite perfume.

At the meeting of the Academy of Sciences, Paris, on December 12, 1904, M. Labergerie read a paper on *Solanum Commersoni*, which he has been cultivating on rather a large scale. Among other things noted by the observer was the production of a variety with purple-skinned tubers, which produced plants of robust habit and immune from the attacks of the Potato fungus *(Phytopthora)*, while other plants originally derived from the same source were severely attacked by disease. The percentage of starch has risen from 11·5 per cent. in 1901, to 14 per cent. in 1903, and 17 per cent. in 1904, and the flavour of the tubers is stated to be excellent. *Solanum Commersoni* has hitherto been recommended in France as a forage plant only, but M. Labergerie's trials show that this variety is also productive as regards the tubers, that these are of good flavour, rich in nutriment, and specially adapted for cultivation in wet soils that are ill suited for ordinary varieties.—*Gardeners' Chronicle.*

Forestry.

Some Practical Notes on Forestry suitable for New South Wales.

J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

VIII.

Definitions.

Let us begin with a few definitions :—

1. *A high or seedling forest* has sprung from seed, naturally or artificially (in Australia the former vastly preponderates). This is cut over, and the trees removed are replaced by seedlings, and so on.

2. *Coppice forest or copse.*—In this case the trees have all been cut down, either close to the roots (stool shoots or suckers), or with varying lengths of stems (pollards), and suckers springing up form new trees. This process can be repeated almost indefinitely with some trees.

3. *A combination of seedling or coppice forest.*—This is sometimes called "Coppice with standards," or "stored coppice," and consists of an admixture of (1) and (2). Here the forest consists of an "overwood" or large trees, and an "underwood" of small stuff, the latter consisting of coppice, and the former either of seedling trees or of coppice shoots, allowed to develop into large trees; these are called "standards" or "stores."

It is obvious, therefore, that all forests must consist of either of the following :—

1. High or seedling forest.
2. Coppice forest.
3. A combination of seedling and coppice forest.

Natural Regeneration of Forests.

The phrase "natural regeneration" of forests is self-explanatory. In reiterating that what we mainly want in New South Wales is conservation, as opposed to planting, I am simply expressing, in other words, the opinion that the natural regeneration of our forests should mainly be attended to.

Even in Europe, where planting comes more within the range of practical forestry than with us, this phase of the subject is of primary

importance, no matter how much it is neglected. Here is the testimony of two eminent British foresters:—

> Nothing strikes a student of English forestry more forcibly than the almost utter disregard which is paid to the possibilities which exist of regenerating woods by natural means.—(A. C. Forbes, *Gard. Chron.*, 22nd June, 1901, p. 400.)

And again—

> In France natural regeneration, either by seed or by coppice shoots, is the chief means of reproducing a forest, and human interference with the growing forces of Nature is reduced to a minimum.—(W. R. Fisher, *Nature*, 1st November, 1900, p. 1.)

Let us turn to India:—

> Here in India it is necessary to rely almost entirely on the natural reproduction of our forests. For a more intensive management the areas to be treated are by far too vast, and the average cash revenue per acre is too insignificant.—(Ribbentrop, Forestry in British India, p. 166.)

Surely this expresses the conditions of New South Wales.

The policy of a New South Wales forester should be that of masterly conservatism based on a thorough knowledge of the topography of the forests and of their component trees, in contradistinction to a feverish desire to "do something."

The Spontaneous Growth of Trees.

Natural regeneration or re-afforestation is proceeding often without our knowledge, and even in spite of ourselves—quietly, surely.

"I was informed* here (Failford) and also on the A. A. Company's Estate (Gloucester) that formerly the hills were often destitute of timber where now there is dense forest. The reason of this change is attributed to the over-stocking of the country, the stock eating down the grass so that bush-fires (which formerly consumed the seedlings of forest trees) are now less frequent, and devastate smaller areas of country than they used to do. . . Mr. Forester Rudder expresses the opinion that cattle directly aid the propagation of trees by trampling the seeds into the ground."

In Australia and Tasmania the following experience is not uncommon. When sheep are folded the manure becomes quite thick. In a few years, if the sheep be removed, eucalypts come up freely. This occurs in places in which they were not previously found. It seems to me that this points to the sheep licking up the seed with their feed and redepositing it in manure. Vigorous growth would take place in fertilised soil. Perhaps this matter of natural afforestation (not re-afforestation, as it takes place in areas not previously known to carry trees) may be entirely explained by herbivora grazing in forest land and depositing their dung on non-forest land. The obvious reason why this afforestation does not take place more abundantly is because sheep and cattle readily eat down young seedlings, which must, therefore, be protected accidentally or otherwise in order that they may reach maturity.

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*Maiden in *Agricultural Gazette*, N.S.W., vi., 593 (1895).

Howitt deals with the "Influence of Settlement on the Eucalyptus Forests" in his paper on the Eucalypts of Gippsland.* He speaks of the annual bush fires of the aborigines which tend to keep the forests open, consuming much of the standing or fallen timber and largely destroying the seedlings. At the same time these burnings-off destroy many of the insects that prey on eucalypts. When the white man came he discouraged bush-fires, and the young seedlings had now a chance of life. He gives specific instances of whole tracts of country being covered with forests of young saplings since the advent of the white man. No one has a more intimate knowledge of Gippsland than Mr. (now Dr.) Howitt, who says, "In spite of the clearings which have been made by selectors and others, and in spite of the destruction of eucalypts by other means (plagues of leaf-eating insects), the forests are more widely extended and more dense than they were when Gippsland was discovered by the white man."

This natural spread of forests should be a comfort to those who are apt only to consider the destructive action of the timber-getter, and to lose sight of the compensating influences that are at work.

The springing up of young forest growths where there was formerly forest is, of course, common enough. We do not know how long many seeds will remain dormant in or on the ground after the old growth has been removed. It is not an uncommon thing to see a straight avenue of trees not artificially planted. One fine avenue known to me is along the line of an old chock and log fence, and consists of She Oaks (*Casuarina*).† Oak saplings were used as toprails for this fence, the seed from the saplings germinated, and the young growth was protected from stock by the fence. The seedlings grew into fine trees, and finally the old fence was removed, leaving only the line of trees which followed the direction of the fence.

What is Sylviculture?

Sylviculture has been defined as that part of forestry which relates to the planting and cultivation of groves and collective bodies of forest trees. It is really a very comprehensive term.

Speaking of forestry in India, the late Inspector-General of Forests in that country remarks:—"All we can, in the majority of cases, succeed in doing is to protect our forests as much as possible against fire, grazing, and other harmful interference, and to exploit them in such manner as to give natural reproduction the best possible chance, and to assist the regeneration of the natural forests by such sylvicultural measures as the circumstances of each case may demand."—(Ribbentrop, "Forestry in British India," 167). Here we have what may be taken as another definition of Sylviculture.

Pruning is a nursery operation, and is rarely applied to trees in the forest. The necessity for pruning is an indication of bad forestry, as, if the trees are planted suitably, or properly thinned out, Nature will do her own pruning.

* *Trans. Royal Soc., Vict.*, 1890. † *e.g.*, *Agricultural Gazette*, vii., 514.

One is often asked "At what distance apart should trees be planted?" One cannot answer this question unless the kind of trees be stated, and the climate, soil, and other conditions be given. Endeavour should be made to choose a medium distance apart—one which will permit us to obtain both height and girth in fair proportion in the mature tree. The trees should be close enough for the lateral branches to die off, but not too close, otherwise they may die off before they have performed their functions connected with the sturdy and symmetrical growth of the tree.

Forest-thinning.

One phase of Sylviculture bears the name of Forest-thinning—an expansible term, by the way.

This is a necessary operation of the forester, just as necessary as the weeding and clearing up of the gardener. Unfortunately it has got into disrepute with some people in this State because it has been associated with "relief work," whereas the best results can only be obtained by skilled labour.

When we thin a forest we have an object in view, and the operation should be subjected to rigid scrutiny on economic principles. Forest-thinning may have for its chief object:—

1. The harvesting of the forest crop.
2. The conservation of the interests of the remaining trees.
3. The conservation of the grass and other fodder plants.

Forest-thinning is a matter of considerable practical importance to us in this State. It is a subject which requires to be approached with a spirit of respect and caution, as it involves pitfalls. Because a man can thin out lettuces or verbenas, it does not follow that he can undertake forest-thinning successfully. And the greater caution is required because the effects require time for development; we might possibly pay a man for work of this kind when it would have been sounder policy to pay him for inaction. I hardly know a forestry operation requiring greater skill on the part of the overseer than that of thinning. Work of this kind can with difficulty be directed from a distance, and empiricism in dealing with a natural forest must be done away with as far as possible. If we had a natural forest on an absolutely level plain, with conditions of drainage everywhere similar, soil and subsoil alike in every respect, the winds and moisture precisely similar in their effects over the entire area, then we could decree that the ultimate thinnings should leave the trees so many feet apart, which result could be attained either at once, or by so many intermediate thinnings. But such conditions nowhere exist, and each patch of forest requires the individual consideration of the operator. The local conditions require careful study in every instance, for the too abrupt alteration of the conditions under which a tree is living, by ill-advised clearing in its immediate vicinity, may do a tree harm rather than good, may retard its growth, even if it does not induce actual disease. Careless thinning may cause trees to be bark-bound, to send out lateral branches, instead of forming a straight

bole free from knots, and may have injurious effects in other ways. I am quite aware that it is difficult to secure the services of men who are capable of carrying out such work satisfactorily. Men should remember that the taking down of a number of trees in thinning operations is different in character to the removal of a number of stone or iron columns, and those entrusted with such operations must have a knowledge of the physiology of plant-growth, and shrewd common sense to decide, under all the varying conditions of a specific locality, what is the best action to take, how to vary, in different parts of the same forest, the degree of thinning.

One rule in forest-thinning should be borne in mind (*i.e.*, where merchantable timber, and not merely landscape effects are in view), viz., the necessity for keeping the ground shaded as much as possible, as exposure to the direct rays of the sun and the beating effects of the rain, alike diminish the productivity of the forest.

The following observations were offered by me a few years ago when the subject of Cypress Pine (*Callitris*) thinning came under review :—" I do not see how one can make much progress in giving instructions *re* thinning without data, as to the closeness and condition of the trees, to begin with. Then I believe in gradual thinnings. I think the practice of our Forest Department to thin pine to distances of 7 feet to 10 feet is sound in many cases; at all events, it is prudent practice. Amery says, the golden rule of a young forester is 'Do not do too much,' which is an excellent dictum. Where it is desired to thin out to distances of 20 or 30 feet apart, this result should be attained as far as possible by successive thinnings, as thinning should be a gradual process. At the same time, the size of existing timber, its state of health, the closeness of the trees, the nature of the country, may render it desirable to thin out to 20 or 30 feet in one thinning in certain cases.

"I have travelled a good deal in pine country, and feel that one must be largely advised by reports of inspections unless one has actually visited an area in question. In absence of a report from an experienced forest officer one must largely rely upon the reports of surveyors.

"We have to modify European practice here. In Europe, after a sharp thinning, a shade-loving undergrowth is established to shade the forest floor. Here the forest floor is required for grass. The grass crop can only flourish with plenty of light. The timber crop requires plenty of shade, except at the crown of leaves. In consequence, the utilisation of pine and other forests for grass-growing must be in the nature of a compromise, and the forestry question is complicated, because we have to take cognizance of grass.

"If thinned pine country is to be continuously available for pasturage, one must take care that stock do not destroy all the seedlings, as, when the trees are ready for the saw-mill, there will be no timber crop in various stages of growth to take its place.

"In other words, scientific forest conservation must be kept in view."

Thinning a Natural Process.

Let us enter a forest and look around us. What do we see? Competition going on on all sides—in other words, the struggle for existence, and, in a technical sense, the survival of the fittest. Picture the forest to-day, with perhaps nothing offensive to the trained eye of the forester. Revisit it in a few years, and what do we behold? Certain trees have outstripped their fellows, and have become "dominant." They may be worthless species, and it may become our duty to fell them. Other trees, stinted of light, moisture, and nutriment by these dominant trees, have become spindly, depauperate, or show incipient disease. If the dominant trees be not checked, some of their neighbours will die. Now we may remove a dominant tree, because it has attained maturity and may be converted into timber, or because it is a worthless species, and therefore "cumbereth the ground," injuring and even destroying its neighbours. Or we may accept the situation and allow it to grow, realising that the destruction of other trees is a natural process. Here is where the skill of the forester finds play. He sees this process of natural competition going on all over his forest (I am speaking chiefly of mixed forest for the moment), and he destroys a worthless tree here, fells one for timber there, and thins out depauperate trees in various places in order to stimulate the competition of straight-growing likely trees.

In this thinning oftentimes the forest officer leaves the matter largely to Nature, only interfering when he observes flagrant conduct on the part of his tree charges. And, I repeat, the attitude of the forester in New South Wales should be largely a watching one.

In some cases, the European forester may, however, thin out sharply, in order to allow the development of certain trees, which have attained their average height. But this is a refinement of sylvicultural practice which has not often been taken cognizance of in forest-thinning in New South Wales.

Trees should in a well-regulated forest not be permitted to grow beyond maturity, but in this country they are often so permitted, to the detriment of the surrounding trees, simply because it is too costly to fell and remove them. This fact, coupled with the comparative indestructibility of our timbers, will always, or at all events for many years, militate against an ideal forestry system in New South Wales.

It is a matter of common observation that the most worthless species are the most abundant seeders. Furthermore, such trees often crowd out more valuable ones.

The thinning-out process is not only applied to worthless kinds, but also to broken, injured, ill-formed, diseased, or depauperate trees of any kind.

When a tree falls naturally or otherwise in the forest the surrounding conditions are altered. It ceases to draw stores of nutriment from the soil. It ceases to shade the ground and adjacent trees. The shade of the tree which has fallen is more or less imperfect, and this diminution

of shade increases with the distance from the trunk. In this modified shade there are trees of various sizes, which flourish more or less proportionately to the amount of light available. When the tree falls the new conditions induce the development of those trees whose growth has been arrested by the dominance of the tree which has now fallen, while a new crop of seedlings springs up. Competition arises between these seedlings, some dominate the others, and so a fresh generation of trees springs up, and the consequences of competition which have been already described are once more repeated. In cutting out valuable timbers and leaving the inferior ones, arrangements must be made for re-seeding, by clearing or burning an area, or the valuable timbers will, in process of time, be exterminated.

This process of regeneration in a primæval forest like those of New South Wales may go on for centuries. Changes are constantly taking place in the forest, and the forester's business is to make his plans accordingly. He removes his trees when they are ready for his purpose, according to various systems which are employed as special circumstances indicate.

These systems to be found in the text-books (*e.g.*, Schlich) are both numerous and of a most elaborate character. But these details are only attended to in high European practice, where trees are for the most part artificially sown or planted out, the various kinds usually kept apart, timber costly, the cost of supervision cheap, penalties draconian, and so forth.

These details must be much abbreviated in Australian practice for obvious reasons.

An Australian System of Forestry required.

Let us therefore evolve an Australian system of forestry here, *i.e.*, a system suited to Australian conditions. Let us emulate the Germans in their attention to detail, desire to get at the bottom of things, and love of work for its own sake; but the transplanting of the German system of forestry to Australia can only result in disaster.

I will now deal with three methods of Sylvicultural treatment which are more or less applicable to Australian conditions.

1. *Felling by Selection* (*Plänterbetrieb*, of the Germans; *Jardinage* of the French, or sometimes "*fuertage*," *i.e.*, "stealing" from the forest).

The meaning of the title of this method is a literal one, the trees are "selected" to be cut over. We may call it a thinning.

In this system we go over the forest and remove yearly a calculated number of single trees or small groups which have attained maturity. (With this removal of marketable trees is often combined an ordinary thinning of inferior, worthless, or injured trees.) This operation, being repeated yearly, or at other intervals, practically no part of the forest is ever at rest.

The system of felling by selection has much to recommend it in the circumstances of New South Wales, particularly as regards the coastal forests—in fact, it is often followed here. It is specially adapted for

country where one must keep up a permanent growth of some kind, and for rough country generally, *e.g.*, on the sides of mountains, to prevent landslips, erosion of banks, and to preserve the country around the beginnings of watercourses. It is a flexible and useful method in the hands of a careful forester.

Nevertheless, it has its drawbacks, and it is alleged against it, with a certain amount of truth, that, unless care be exercised, bare places are very apt to form, and the general tendency is to a continual narrowing in of the boundary and final clearing off. In such irregular forests the wind is calculated to do more havoc than when the forest growth is more uniform.

But the chief objection to the selection method is that it encourages empiricism, and possible final loss of control of the forest, and eventual bankruptcy. I cannot do better than quote Amery's words :—

But on the Plänterbetrieb, experience of Germany has shown, not only that it is difficult to maintain uniformity of yield, but that there is commonly a temptation to secure good financial results in the present, in the hope that they may be maintained permanently, at least for our own time ; and as it is difficult to determine the amount of standing stock and average rate of annual increment in a forest of trees of all ages, this hope is not always well founded. We may base our plan upon a fairly reliable estimate of trees of the final period, and may have fair data for assuming that there is an equal number of trees in the penultimate period of growth to take their place when they shall have been felled ; but unless we are secure of a corresponding area of trees of each younger period, we may, in time, have to suspend operations, or lower the felling age by perhaps twenty years, to the lasting impoverishment of the forest. As has been already said, we cannot trust to numbers of young trees, for if these grow in clumps, only one in many of them can ever reach maturity.—(Amery, "Notes on Forestry," p. 112.)

2. *Felling by Rotation of Area.*

But for forests of gregarious trees, *e.g.*, those of the Cypress Pine of the West, the Ironbark of the North-west, and the Red Gum of the Murray, the method of felling by rotation of area is well worthy of consideration. It is an ideal method for planted forests, but with natural forests, and those whose reproduction must be largely left to Nature, we must, in practice, abandon mathematical precision.

The forest is divided into blocks, as many in number as there are years in the rotation. This, in Europe, is sometimes fixed at a hundred years.

Thirty years is, however, rather a long rotation for India ; on good soil, and in a fairly moist climate, it may be as low as twenty, and in some cases less. The plantations of Australian trees on the Nilgiris are treated on a rotation of only ten years for Eucalyptus and five years for Wattle, and at these ages afford a really wonderful amount of material.—(Gamble, *Proc. Roy. Col. Inst.*)

That is to say, each block is gone over in turn, so that cutting returns to the same part only after the lapse of a specified number of years.

In New South Wales the rotation would not usually be longer than obtains in India.

On the system of rotation of area with a fairly just proportion of stock of all ages, and with moderate uniformity of soil (reproduction being ensured), it is easy to secure uniformity of yield for all time.—(Amery.)

In practice it will be found that there is no abrupt transition from the system of felling by selection to that of felling by rotation of

area. But the latter method is an ideal, and should always be kept in view. Approximation to it will tend to eliminate empiricism from the operations of the forester, and make his returns comparable to that of a gilt-edged security—certain and uniformly remunerative, not spasmodic and uncertain.

3. *Method of Coppice-growth*—(German, *Niederwald*).

The term "coppice" is applied to a forest that is cut over completely when the timber has grown to a size for the uses of which it is intended, and a new growth is allowed to spring up from the roots and stumps. Usually young vigorous trees coppice best.

Fellings for coppice should always be done with an axe, as shoots from sawn stumps are liable to windfall—nor should the top of the stump be left hollow, or water will lodge on it and cause decay.

Coppice stems grow much quicker than seedling stems in their first stages, but retardation of growth sets in sooner. In Europe the average proportions between coppice and seedling stems has been worked out for a number of trees, but very few data are available for Australian ones.

Although the propagation of forest trees by coppice-growth scarcely exists in Australia as a branch of industry, coppice-growth under the name of "gum-suckers" is too well-known to the pastoralist. In the forests also, without deliberate intention, coppice-growth enters more largely into the regeneration of the forest than appears to those who have not studied the question.

Our native trees may be divided into those which coppice well and those which do not. Unfortunately some trees of little value to the forester coppice freely. The method is well worthy the attention of landowners who desire to reafforest areas, and the method has the advantage that trees may be obtained by coppice-growth in places where it is inconvenient or impossible to reproduce them by planting.

Some useful Australian Trees which coppice freely.

Stringybark.	Blackbutt.	Red Cedar.
Spotted Gum.	Tallow-wood.	Tulip-wood.
Mountain Ash.	Turpentine.	She Oaks.
Box.	Native Teak.	

Amongst important timbers Ironbark and Cypress Pine do not coppice freely.

Cheese Grading in New Zealand.

W. GRAHAM,
Assistant to Dairy Expert.

THE system of grading cheese, which has been adopted and carried out by the New Zealand Government for a good many years, has done much to raise the standard of that product.

When cheese was first shipped the conditions were totally different to what exists at the present time. Previous to grading, cheese was shipped as ordinary cargo, without any provision being made to regulate the temperature during the voyage from New Zealand ports of shipment until they reached London, the result being that the cheeses were arriving at their destination in anything but good order. In some cases they had become heated during the voyage, and were condemned as unfit for use. Complaints were also coming back about broken crates and light weights both from London and Australia.

The New Zealand Government began to realise that if something was not done the industry would simply be ruined. The grading system was, therefore, introduced, which has been the means of raising that product to its present high standard of quality and uniformity of article throughout.

The System.

The chief ports or centres of shipping were gazetted grading ports, a Government official, or grader, being stationed there, his duty being to watch the different shipments handled, and also to inspect each lot from the different factories separately. He would then make a report on the quality of the article, and also the defects, if any, in the manufacture, and would take 10 per cent. of the cheeses out of their crates and weigh them, to see that the weight marked on the crates was correct.

A copy of that report would be sent to the factory, and another to the buyer, or forwarding agent. The crates would be stamped with a first, second, or third grade mark, according to the quality of the article. Any cheeses which were as low as third grade, and which would have a damaging effect to the trade, if shipped, would be promptly held back.

The instructor, on visiting the shipping ports, could at once see where his services were required, and would at once proceed to any factory where poor work was being done, and would invariably succeed in putting things right.

The System from a few Different Points of View.

The Factory Manager.

The system as it affects the factory manager is, in his case, not only a grading of cheese, but also a grading of managers, inasmuch as when the article he manufactures is not first grade, through his inability, or through being careless and indifferent in his work, it is brought before the eyes of his directors, through the medium of the grade report, and he is very soon asked to do better; failing that—his dismissal, and a more capable man will fill his position.

Then, again, if he is a careful manager, the grade report acts as instruction to him, insomuch as he sees where his faults are, and will try to remedy them, and, by persevering, he will attain that state of efficiency in his work, resulting in a high-scoring grade report, which will merit the praise of his directors for his good work, and also inspire confidence in him as a manager, and also very often be the means of raising him to a higher position.

The Board of Directors.

It is a safeguard to directors of a factory in the sale, and also the handling, of their output. They know that when their cheese has been graded, and marked first grade, that it is of good quality, and should command the top market price; or, on the other hand, if it is second grade, they are prepared to take a much lower price. Then, again, they also know that when their product leaves their factory for shipment, it is under the eyes of the grader until it is safely on board the steamer which takes it direct to the end of its destination, and is, therefore, receiving careful handling and proper treatment during its transit. Another very important point: should directors have to apply for a manager to fill a vacant position, to find out the capability of the different applicants they have simply to ask them to present their grade reports from their last factory, and the man who can show the highest-scoring grade reports is the man who invariably is selected to fill the position.

The Milk Supplier.

The supplier is well aware that the manager is expected to turn out a first-grade article, and it is his duty to attend to his end of the business, as co-operation is not co-operation unless it is carried out properly; it is essential to the success of a factory that there is co-operation with manager, directors, and suppliers, it is, therefore, the manager's duty to be at the intake of the milk, and there reject any milk which he thinks will not make a first-class cheese. It is the supplier's duty to exercise thorough care and attention, to see that cleanliness is practised in every detail to ensure the milk arriving at the factory in a clean, and sweet condition, thereby assisting the manager to turn out that first-grade article which brings the top market price, and which gives him a better price for his milk than if it were a second-grade article that was being turned out. It is, therefore, needless for a supplier to try and pass milk in an unsound condition when he knows that, if taken in, a second-grade article will be the result, thus damaging the reputation of the factory.

The Buyer.

In the majority of cases the output of a factory is sold before the season commences. The buyer, therefore, visits a factory, or factories, and will buy the whole, or part of a season's output before very often a pound of cheese is made, knowing that, if he makes a stipulation that all cheese must be first grade, his contract will be filled with cheese of first quality. In the event of a shipment being second grade, it is held back, or very often the buyer agrees to take it at a reduced figure; it, therefore, has the second-grade stamp on, and cannot be passed off as a first-grade article at the other end.

Through the help of grading supervision, I might say that the cheeses invariably arrive at their destination presenting a neat and clean appearance, and inviting to the eye of the consumer. They are packed in crates with round or polygon-shaped ends; two cheeses are placed in each crate, with a centre-piece between (with a space of about an inch between each batten forming the sides of the crate), to allow the admission of air around the cheese. The size of the cheese generally is 14 by 14 in., the weight being from 60 to 70 lb.

Poisoning Foxes in the Cowra District.

Foxes having been seen on several occasions, it was decided to lay poison, and baits were prepared as follows:—Mutton fat was cut into 1¼ in. cubes, a knife and fork being used to avoid handling, a cleft was made in the bait with the point of a knife, powdered strychnine placed therein, and then pressed together. Three rabbits were shot and taken round on the poison cart to a spot near where foxes had been frequently seen, a fire was made with a few leaves, and two rabbits placed thereon until well charred, so as to make an attractive scent. Two small holes were scratched, and a bait placed in each and lightly covered with soil; the liver of the third rabbit was also poisoned and thrown in the ashes; one charred rabbit was then trailed behind the poison cart for a distance of 15 chains, then dropped and two more baits laid, one other being dropped on the trail. No baits were taken the first night. Three days later three foxes were found dead within 3 chains of the trail, and two other live ones were seen the same day. Had more baits been laid, no doubt more foxes would have been killed.

I think a sheep's head would be better for a trail, and sheep's liver or tongue for baits. A trail could be readily drawn on horseback, and the baits dropped; but covering is advantageous, as they would not be removed by birds, and thus remain for days. Covering the bait also reduces the suspicion of the fox. A caged rooster would be a good device to attract foxes to a spot where baits were laid. Poisoning is preferable to hunting, the latter only drives them away and after a time they return to their old haunts.—John O'Neil.

A High Testing Shorthorn.

M. A. O'CALLAGHAN.

SHORTHORNS, as a rule, do not give very rich milk, yet it is known that some strains or families are exceptions to this rule. I have been informed that the progeny of the State-imported bull, Cornish Boy, give exceptionally high tests for Shorthorns. The cow that obtained second prize in the non-pedigree Shorthorn milking classes, at the last London Dairy Show, tested 5·04 per cent. of butter fat in the morning, and 5·02 per cent. in the afternoon. Her milk yield for two days averaged 26·5 lb. in the morning, and 22·4 lb. in the evening. She gave 2·45 lb. of butter fat per day, which is equal to nearly 3 lb. of commercial butter per day. She was seventeen days calved at the time.

MILKING TRIALS AT THE LAST LONDON DAIRY SHOW.

Some Points of Interest Regarding the Breeds Competing.

The following table gives the milk yields and butter fat yields of the First Prize cows in the breeds competing:—

	Milk Yield per day.	Butter Fat per day.	How long Calved.
	lb.	lb.	days.
Pedigree Shorthorns—			
Joyous	44·4	1·65	30
Non-pedigree Shorthorns—			
Wibby	58·0	2·11	29
Jerseys—			
Marryatt's Lassie	39·6	2·25	144
Guernseys—			
Princess Lily	34·6	1·95	144
Red Polls—			
Honest Wayward ...	56·6	2·10	62
Kerry Cattle—			
Buckhurst Gem	38·7	1·79	15
Dexters—			
La Mancha Beatrice ...	40·4	1·65	79
Other Breeds—			
Primrose (South Devon) ...	57·5	2·37	177

There was no award in Ayrshires, the only cow tested falling below the standard.

The Dairy Farmer, The Butter Factory, and The Cream Chart.

M. A. O'CALLAGHAN.

In a previous issue of the *Agricultural Gazette* I dealt with the question of over-run in butter-making, and to whom that over-run belonged. At the head of the Cream Chart published with the December issue of the *Gazette*, some particulars are given in explanation of the basis of the chart. Nevertheless, farmers who ask to be paid in accordance with this chart find trouble with some factories in getting them to adopt this basis. The factory manager tells the farmer the chart is too high, that the allowance for moisture, etc., is too great, and that they cannot pay up to it. Such is the position. There is nothing clearer, however, than the fact that the chart has given our farmers a basis to work on, that they are finding out they are not paid for as much butter as they ought, and that if those factories who endeavour to pay their way by retaining a part of the over-run do not reform their methods, trouble will ensue which may affect their trade very considerably. A number of farmers keep sending samples of cream to me to be tested for fat, and these are checking the factories. One farmer in each factory acting thus, provided the manager does not know the farmer who is doing it, is quite enough to check the whole returns of that factory. Some of the letters written me on this subject will serve materially to illustrate the position in a manner acceptable to dairy-farmers, and hence a few are inserted here, leaving out the names and addresses:—

Sir,

Would you kindly answer the following question:—I supplied 955 lb. of cream to a factory. Test register, 40·5. I was paid for 466 lb. commercial butter. Is that correct? Yours, &c.

Reply.—The amount paid for is in accordance with chart published by me, and is correct from that basis. This is the minimum amount which should have been paid for.

Sir, 21 Feb., 1905.

I am forwarding you a few tests to make up, as the accuracy of your chart has been challenged.

From the chart I received from you, I made a great difference between it and the results given me by the manager of our factory; so I made a complaint and was beaten. If you will oblige by making them up, and state the quantity of moisture you have allowed, you will greatly oblige. Yours, &c.

Dear Sir, 9 March, 1905.

I received your letter informing me that an accident had prevented a test of my cream being made I should have liked very much to have had it; but, however, it cannot be helped. Before receiving the above I had sent you another sample, but I am not sure I sent sufficient.

If you could send me half a dozen bottles of the required size it would be better. I will pay the cost.

I intend sending you more samples to be tested. If you could forward the result of sample sent to-morrow you will oblige as a meeting of Directors takes place on Thursday next, and, as I happen to be one of them, I could then present it.

I feel very grateful to you in taking the trouble to look after the farmer's interests.

Sir, 22 Feb., 1905.

I have to thank you for instructions how to work Cream Chart. I checked my returns from the factory last month (we get paid on the 15th of the following month). By your chart I worked it out as you directed, and the secretary and manager both say your chart is wrong, and that they do not work out their returns from it. I am sending you the results as worked out by them and myself. Would you kindly let me know how much butter I should get paid for, and also explain what over-run is allowed out of amount of cream, say, 31 per cent. test, 85 lb. weight. Your chart says 31·30 lb. The secretary claims 15 per cent. over-run out of that. I want all I am entitled to and no more. I am a shareholder in the factory. Kindly let me have this information as soon as convenient.

Yours, &c.

Date.	Weight.	Test.	Butter.
Dec. 27	113	41	56·04
,, 30	98	36	42·33
Jan. 2	113	41	56·04
,, 4	80	40	38·64
,, 8	99	40	47·81
,, 9	85	32	42·47
,, 11	75	35	31 50
,, 14	102	34	41·51
,, 17	112	32	42·78
,, 20	83	43	43·24
,, 23	79	46	44 24
,, 25	56	48	32·81
,, 28	83	40	40·08

The factory, from these figures, pays me for 518 lb. of butter. From your chart, and the above, the correct weights, tests, &c. :

I make it	549½	lb. of butter.
Factory	518	,, ,,
A difference of	31½	,, ,,

These returns show clearly that the farmer was paid for 31 lb. butter less than he should have been.

Over-run Moisture.

Some people imagine the only matter in butter besides fat is water, and one man, not a farmer, who has been discussing the question. told me he thought what the analysts called moisture or water covered everything, and that when salt was added to butter and dissolved it became water! This is not so. Moisture is water pure and simple, and it does not include salt, preservative, curd, milk, sugar, &c.

Another commercial man asks:—"How do you get 17½ over-run when butter contains only 12 per cent. of water; and how can a factory be expected to pay this 17½ lb. of over-run per 100 lb. of butter fat. Where do you get the other 5½ lb.?" The notes at the head of the chart explained this fully enough for those who understand factory work even a little. For every 85 lb. of butter-fat, plus what is lost in butter-milk, put into the churn in the cream a lump of butter weighing at least 100 lb. is made. If there are 100 lb. of

butter-fat put into the churn, in addition to the portion lost in butter-milk, at least, 117½ lb. of butter are made. To make this still clearer, 100 lb. of very dry butter contain as follows :—

85 lb. butter-fat,
11½ lb. water,
2½ lb. salt and preservative,
1 lb. curd, milk, sugar, &c.

But, if the butter be of the average, it will contain at least 12½ lb. of water, so that in this case the factory has 1 per cent. to the good over the chart calculations.

Now, 117½ lb. of butter on the same basis contains :—

100 lb. butter-fat, and
17½ lb. of matter other than butter fat,

so that my inquirers will clearly see where the 17½ lb. of over-run is obtained. The factory is not asked to pay for 17½ lb. of over-run for every 100 lb. of butter made; but for every 117½ lb. of commercial butter the factory puts up. The allowance made for loss in butter-milk should be more than ample for a properly-worked concern, and the other allowances made by adopting a low percentage of water, salt, curd, &c., should compensate easily for the allowance of half a pound extra put in each 56 lb. box. The proof of the pudding is the eating. Some of the largest factories in this State, and even in Victoria, are paying on this cream chart, and if they can do it, it shows clearly that other managers who know their business can do likewise. It can be clearly understood that factories which have been retaining a certain percentage of the over-run to pay expenses will very reluctantly abandon that system, unless they are assured that those factories competing with them will also adopt this chart as a basis for payment.

What will probably happen before matters adjust themselves properly is that some supplier will take a factory into court, and that will settle the whole question. A factory manager may not be able to work up to this chart for any of the following reasons :—

(1) If the refrigerating machinery is working badly, and the manager is unable to cool his cream thoroughly, the loss in butter-milk will be heavy.
(2) If the cream storage facilities are inefficient, the manager may not be able to allow the cream time to cool properly, and thus the same heavy loss would occur.
(3) If for any reason the manager churns cream only a few hours separated the loss in butter-milk will also be heavy.

The cream chart in an extended form, together with a milk chart, and all instructions how to test milk, cream, &c., will be published in book form in a few days. Copies can be obtained from the Government Printer, and from all booksellers, at 2s. 6d. each.

Weeds of New South Wales.

"Prickly Lettuce" or "Compass Plant" (*Lactuca Scariola*, Linn.).

J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

Botanical name.—*Lactuca,* Latin for lettuce; *Scariola,* Latin for wild salad.

Botanical description.—

Rather scabrous below, leaves suberect, radical obovate-oblong sinuate-toothed or runcinate, upper sagittate amplexicaul, auricles acute spreading, branches of panicle long spreading, fruit grey. Waste places, rare, Worcester, Norfolk, Essex, Kent, and Surrey; native (?) Watson; fl. July–August. Closely allied to *L. virosa,* but prickly only towards the base: branches more erect; leaves usually more runcinate; heads smaller; fruit narrower. ("The Students' Flora of the British Islands." Sir J. D. Hooker, 2nd Ed., p. 226.)

The Prickly Lettuce a Parent of the Common Lettuce.—Alphonse De Candolle ("Origin of Cultivated Plants") says:—

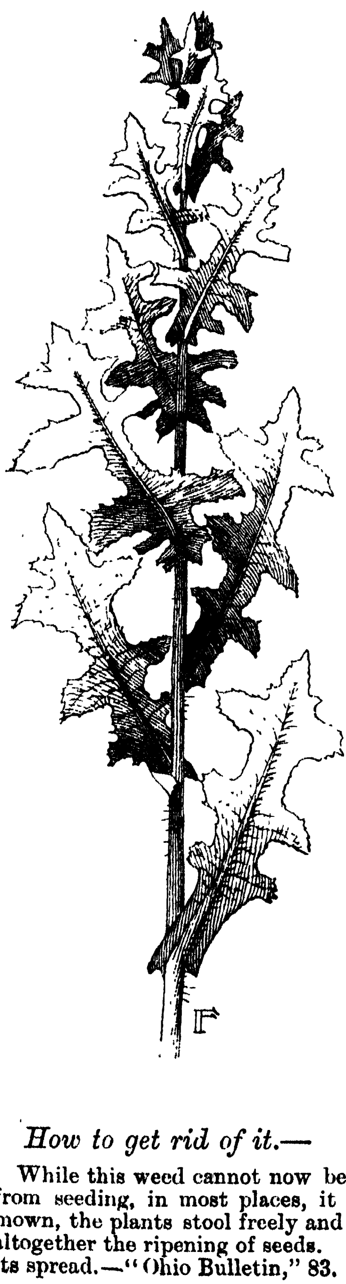
Botanists are agreed in considering the cultivated lettuce as a modification of the wild species called *Lactuca Scariola.*" The common lettuce is, indeed, known to botanists as *L. Scariola,* var. *sativa.*

Vernacular names.—"Prickly Lettuce," from the prickles on the wavy margins, on the midribs of the leaves, on the lower side, and lower part of the stem. Its milky juice, yellow heads of flowers, and other characters, show its affinity to the common vegetable lettuce. It is sometimes known as "Milk Thistle." Its name of "Compass Plant" is so interesting that it will be specially referred to in the next paragraph.

The Compass Plant.—In Europe the leaves of this plant markedly twist themselves in the sun, so that their margins become directed upwards and downwards (*i.e.*, in a vertical position), with their margins directed north and south; hence this is called a "Compass Plant." The physiological reason for this is to enable the lower and upper surfaces of the leaves to be approximately uniformly presented to the action of the sun's rays. *Silphium laciniatum* is another Compass Plant. The following observations refer to our *Silphium* and *Lactuca*:—

Healthy living plants as they grow in the sunny meadows look as though they had been laid between two gigantic sheets of paper, somewhat pressed, and dried for some time in the way plants are prepared for herbariums, and had then been removed from the press, and set up so that the apex and profile of the vertical leaf-blades point north and south, *i.e.*, in the meridian, while their surfaces face the east and west. This inclination is so well and regularly observed by the living plants on the prairies that hunters are enabled to guide themselves over such regions, even under a clouded sky, by means of these plants; for this reason *Silphium laciniatum* has been called a "compass" plant. The life of the compass plant is assisted by this placing of the vertical leaves in the meridian, in that the broad surfaces are placed almost at right angles to the incident sunbeams which illuminate them in the cool and relatively damp morning and evening, while at the same

time they are not too strongly heated nor stimulated to excessive transpiration. At mid-day, on the other hand, when the sun's rays only fall on the profile of the leaves, the heating and transpiration are proportionately slight. It is of interest that the leaves of these compass plants, as well as those of the above-mentioned lettuce, show this inclination and position when they grow on level, moderately dry, unshaded ground ; and that in damp shady places, where there is no danger of over-transpiration from the powerful rays of the noontide sun, the twisting of the leaves does not take place, and they are not brought into the meridian. (Kerner and Oliver, 1, 338.)



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It would be interesting for dwellers in the country to observe whether the "Prickly Lettuce," transferred to the Antipodes, still retains the property of causing the plane, of its leaves to be north and south.

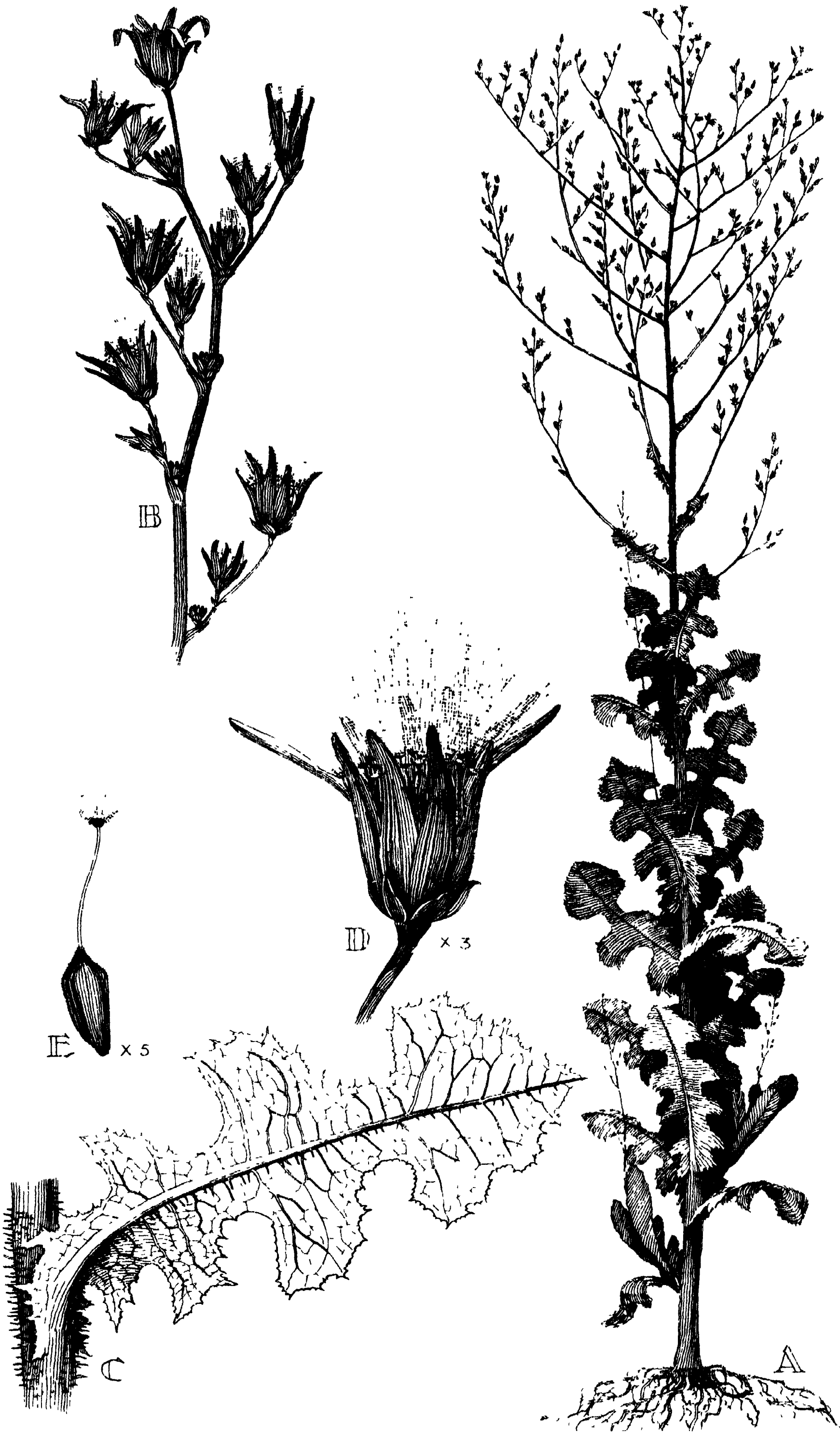
Fodder or Other Uses.—Mr. M. W. Thompson says, "Cattle and horses are very fond of it." Other correspondents have stated that stock nip at it ; but, as a rule, very little is known about it in New South Wales, and senders always express their ignorance concerning it. In Sowerby's "British Flora" it is described as "a bitter, acrid, and fœtid weed." It cannot be specially nutritious, though it is likely enough that stock eat it with other food.

If one turns to Watt's "Dictionary of the Economic Products of India," interesting notes will be found as to the economic value, not only of the Prickly Lettuce, but also of the Common Lettuce. For example, the seeds yield a clear, sweet, transparent oil, while the dried juice (*lactuarium*) has medicinal properties.

G

How to get rid of it.—

While this weed cannot now be exterminated, it may yet be subdued. If prevented from seeding, in most places, it will decrease in numbers and aggressiveness. When mown, the plants stool freely and so must either be cut with hoe or pulled to prevent altogether the ripening of seeds. Community of effort will be most effectual in limiting its spread.—"Ohio Bulletin," 83.



"PRICKLY LETTUCE," OR "COMPASS PLANT"
(LACTUCA SCARIOLA, LINN.)

Prevention of seeding is the remedy.—"Wyoming Bulletin." 31.

A most vigorous but insidious foe.—"Wyoming Bulletin," 31.

The plant has many of the qualities of a successful intruder, as well as an uncompromising weedy appearance. . . . . Where the top is injured, sprouts are sent out from the base of the stem in a very troublesome manner.—"Indiana Bulletin," 52. In Indiana its extermination is no longer considered a possibility.

"A most pernicious weed, a single average plant has been found to bear more than 8,000 seeds." —"Farmers' Bulletin," 28, Dept. of Agric., U.S.A.

I look upon it as a plant whose room is better than its company. In New South Wales it attains a height of 6 or 7 feet. It spreads rapidly, not merely by seed, but also vegetatively, when bruised or cut. So that if hoed out this should be done below the ground surface.

Unlike most annual weeds, the prickly lettuce is very troublesome in meadows and permanent pastures. Clover intended for a seed crop is often entirely ruined. Oats and other spring grain crops suffer more or less damage.

Sheep, and sometimes cattle, will eat the young prickly lettuce, and in some localities their services have been found very effective in keeping it down, especially in recently cleared land where thorough cultivation is impossible. Repeatedly mowing the plants as they first begin to blossom will prevent seeding and eventually subdue them. Thorough cultivation with a hoed crop, by means of which the seed in the soil may be induced to germinate, will be found most effective. The first ploughing should be shallow, so as not to bury the seeds too deep. Under no circumstances should the mature seed-bearing plants be ploughed under, as that would only fill the soil with seeds buried at different depths to be brought under conditions favourable for germination at intervals for several years. Mature plants should be mowed and burned before ploughing. The seed appears as an impurity in clover, millet, and the heavier grass seeds, and the plant is doubtless most frequently introduced by this means. As the seed may be carried a long distance by the wind, the plants must be cleared out of fence rows, waste land, and road-sides.—"Farmers' Bulletin," 28, U.S. Dept. Agric.

Where found.—It is a native of Europe (doubtfully of Great Britain) and Asia Minor, but it has now spread to many parts of the world. More definite localities may be found in De Candolle's "Origin of Cultivated Plants." During thirty-five years it has traversed the United States, from the Atlantic to the Pacific, and has established many permanent colonies by the way. In New South Wales, I received it from Aberdeen (Upper Hunter) and Wollongbar (Richmond River) both in 1899. From Barraba (R. D. Hay) and Tingha (G. J. Hibbard) in 1903. In ringbarked scrubs in the Moree district (Inspector of Stock, 1904), Warrah Run (W. M. Thompson, 1905). I recorded it as a new weed before the Royal Society of New South Wales in November, 1903, and in this *Gazette*, February, 1904. I have received it from a few other localities, and there is no doubt that it is spreading

REFERENCE TO ILLUSTRATIONS.

A. Entire plant.
B. Part of inflorescence.
C. A single leaf.
D. A single flower-head.
E. A single-beaked foint with pappus.
F. A plant with disposed leaves, compass-like, as seen from the east.
G. The same, seen from the south.

(F and G are taken from Kerner and Oliver's "Natural History of Plants," figure 84, [3] and [4].)

The "Sparrow" Circular.

Preliminary Observations on Reports Received at Hawkesbury Agricultural College.

C. T. MUSSON.

We are much indebted to those gentlemen who have filled in the Sparrow circular and sent it along. Whilst thanking the 100 who have already done so, we should like to urge upon residents of all districts inhabited by this bird to send in their observations in order that our information may be at once complete, and therefore satisfactory.

We have a number of most interesting observations from all parts of the State—from Sydney to Hay, and from Cooma to Armidale. A map is being constructed in order to show how far the pest has spread through the State. This will, it is hoped, be published in due course.

The labour of tabulating and preparing the large mass of information already to hand, and coming in daily, will necessitate time for its completion, readers; as well as those who supplied reports, are therefore requested to exercise perhaps a rather lengthy patience, as it is not anticipated that a complete report can be prepared under a year.

A few points in connection with the matter are worthy of attention at the present early stage of the inquiry :—The Sparrow is here to stay, and the problem calls for immediate and continuous action.

1. There are no reports as yet favourable to the Sparrow. It is universally condemned. We may take it, therefore, that although this bird does a certain amount of good all the time (a fact we can prove from the examination of stomachs through the year), yet the amount of mischief it causes and actual damage done far outbalance the good points in its favour; we may therefore look upon this bird as eminently undesirable when in any number; and it would appear that a new duty is falling upon the already burdened shoulders of the grower, that of preventing the sparrow pest from assuming greater proportions than is already the case. Assuredly, if this is not done we shall hear yet a great deal more about it.

2. It appears that this bird is spreading; though it is not yet found everywhere throughout the State, it is a bold and enterprising colonist. Several observers write something as follows:—"A pair appeared twelve months ago, but being promptly shot they were not able to breed and none have appeared since." There is no doubt that if residents in places where it has not yet appeared will keep on the look-out and promptly shoot the first comers; never allowing any to settle; it would be blocked at a stage when it is really possible to do

Supplement to "Agricultural Gazette of N.S.W.," April 2, 1905.

HAWKESBURY AGRICULTURAL COLLEGE,
RICHMOND, NEW SOUTH WALES,
21 *December*, 1904.

IT is desired to obtain particulars as to

Birds causing Damage to Crops.

Sparrows, Starling, Silver Eye, Fruit Thrush, Jay,
Parrots, and other Native Species.

We would like you to assist in this matter by undertaking to record for your district any you may find or hear of doing damage to fruit or fruit-trees, garden, farm, or orchard plants; whether to buds, seeds, roots, or other parts.

It may be suggested that notes be taken at time of observation, giving details as to all circumstances, for transmission to us at end of the fruit season; such notes should contain the following particulars:—

Date—Place of Observation—Name of Bird—Name of Crop and part damaged—Amount of Damage—Comparative Scarcity or Plenty of the bird under review—Any other details the observer may deem desirable.

The stomach and crop may, with advantage, be examined for contents if shot or otherwise destroyed, or preserved in spirit and forwarded to us for that purpose at convenience.

Very valuable information on this subject would be forthcoming if a series of observations on these lines were made and committed to paper, which would be of immense use to an important industry.

It is hoped you may see your way to assisting in this matter. Should you decide to do so, it is recommended that all notes be entered on small sheets of paper, writing on one side only; a fresh sheet being used for each observation. A convenient size is 8 x 5 inches or 4 x 5 inches, or anything near that. These can be kept securely in a box, or tied up with twine.

All information made use of will be duly credited to the observer when published.

H. W. POTTS,
Principal.

Supplement to "Agricultural Gazette of N.S.W.," April 2, 1905.

Do not fail to report in this matter. More answers wanted to make a complete survey.

FACTS, from personal observation, are desired concerning the ENGLISH SPARROW in this Country.

Will you kindly, at your earliest convenience, fill in the following Circular, and post same to the Principal, Hawkesbury Agricultural College, Richmond.

1. *Is the English Sparrow present in your vicinity; if not, what is the nearest point at which you know it to occur. If present, when did it first appear?* ....

2. *Is it abundant and on the increase?* ....

3. *How many broods and young does a single pair rear in a season?* ....

4. *Has it been observed to molest or drive off any native birds; if so, what species are molested or expelled from their former haunts?* ....

5. *Does it injure shade, fruit, or ornamental trees or vines? If so, give examples.* ....

6. *Does it injure garden, fruits, or vegetables? If so, give examples.* ....

7. *Does it injure grain crops? If so, give examples.* ....

8. *Has any case in which it has been of marked benefit to the farmer or horticulturist come under your notice, if so, in what way has the benefit been derived?* ....

9. *Under what circumstances does it feed on insects; what kind of injurious or beneficial insects or their larvæ does it destroy, and to what extent?* ....

10. *What means, if any, have been taken to restrict its increase, and with what result?* ....

11. *Can you give statistics as to sparrows destroyed through special agency (bonus for eggs or heads, &c.) through any Society or Sparrow Club?* ....

12. *What is the prevailing public sentiment in respect to the bird?* ....

13. *Have you any suggestions to make with respect to restricting the pest in the future?* ....

14. ***Name*** ....

Address (in full) ....

something. Once it establishes itself no known means will get rid of it. Inspectors of Nuisances, Town authorities as Aldermen and others, might be requested or even expected to take active measures to this end; for in this work the individual who sees the first pair or flock is the man to take the initiative. Nothing like the present time in such a case. The point is urgently impressed on those interested, as there is a possibility of preventing the pest getting a footing in places not yet possessing sparrow inhabitants.

3. So far there is nothing specially new in the way of "suggestions" for coping with the pest. One observer uses successfully for short distances a charge of "wheat grains" as a cheap substitute for shot. No one seems to have gone in for "trapping" at "flocking" time; nor has "bird-lime" been used at all. The use of a small patch of millet or sorghum as a "trap crop," the heads well smeared with bird-lime, suggests itself; though no doubt the wary birds would, as in other cases, be warned by dreadful example and refuse to be caught. The "scarecrow" or "scareboy" system should be further tried. It would seem to be our only resource as a protection for the wheat crops. Poisoned water might also be given a trial, with due care to prevent accident to stock and dogs; although in the case of poisoned grain, whilst many birds are killed, there soon comes a time when they will not eat it, apparently knowing the danger, or at least suspecting it. It would seem that persistent efforts to reduce their numbers and keep them within bounds is, broadly, our main hope for the future. But there must be no slackening in our offensive work in connection with this bird; it must be regular, and must be perseveringly persisted in. The matter of measures for coping with the pest will be specially dealt with fully at a later date; meantime any suggestions will be welcomed and duly acknowledged.

4. Seeing that these birds largely nest around our houses and in garden trees, and that they are likely to become a worse pest than at present unless something is done and systematic steps commenced at once, it is morally incumbent upon all householders to do their share and try to kill off all birds possible, and to leave no crannies in which they may nest. Co-operation in this way would do much to keep them down. Whilst shooting in the neighbourhood of houses and in towns is to be discouraged, there is no doubt that the inventive genius of man and boy would develop some means for reaching the desired end, without too much gun.

5. All our small insect-eating birds should be protected as far as possible. A few, such as the silver-eye, require to be harshly dealt with at times. We should see to it that, in our measures to kill off sparrows, we do not commit wholesale destruction amongst our native small birds, which, speaking generally, are of great use to us as destroyers of insects and consumers of weed seeds.

6. Seeing the interesting nature of the many communications received, we ask others, who have not yet done so, to make a special effort and send in a record of their observations. All secretaries of Agricultural, Pastoral, and Horticultural Societies, Sparrow Clubs, and other kindred Organisations interested in the matter, are

requested to see that their district is represented by full reports. It would be interesting to know what success has attended the efforts of such societies in the offering of prizes for eggs and a bonus for heads. Information on this head will be very acceptable.

7. We are still wanting reports from the following places—will interested persons please supply:—

Araluen
Albury
Braidwood
Barraba
Boggabri
Bourke
Bingara
Bombala
Bowral
Cootamundra
Carrathool
Condobolin
Coonabarabran
Deniliquin
Drake
Dungog
Eden
Gundaroo
Germanton
Gundagai
Glen Innes
Hargrave
Inverell
Jerilderie
Kiandra
Kiama
Mittagong
Moruya
Molong
Moree
Moama
Manilla
Murrurundi
Nimitybelle
Narrabri
Narrandera
Narromine
Nerrigundah
Nelligan
Northern Rivers
Oberon
Port Macquarie
Queanbeyan
Quirindi
Rylstone
Scone
Stroud
Tabulan
Tenterfield
Tocumwall
Tinonee
Uralla
Ulladulla
Wellington
Wollongong
Warren
Warialda
Wingham
Wee Waa
Western Districts
Young
All Railway Termini

Pigs on Lucerne Pasture.

It is well understood by many hog-raisers that lucerne is a splendid crop for hogs. It has further been observed that young growing pigs until the time they weigh about 100 lb. show the beneficial effects of this crop in the greatest degree. Brood sows also give excellent returns from a field of lucerne. While young pigs are growing and are producing muscle and bone they need food rich in the constituents which go to build up a strong framework. An abundance of protein is needed for that purpose, and this is found in lucerne, hence its value. When hogs are pastured on lucerne, it is more economical to feed some grain in addition, as more economical gains are made in this manner. About half of the regular grain ration fed in connection with lucerne will give splendid results.

Lucerne should never be pastured the first year; and, as a rule, it is better not to do so the second year, but rather cut the crop for hay. By the third year the roots have become well established, are strong, and have grown a good way down into the soil, and pasturing may be begun. It is estimated by some that an acre of lucerne, when the hogs are fed a half-grain ration, will produce 200 lb. of pork during the season. If we credit one-half of this gain to lucerne, the profit per acre from this crop at 5 cents per lb. for the pork would not be less than 50 dollars, which would be a handsome profit, considering the fact that no harvesting was necessary. The great value of green feed for hogs is not generally so well appreciated as it should be. Let us have more hog pastures in the future.—*Texas Stockman and Farmer.*

Hawkesbury Agricultural College and Experimental Farm.

Farm Notes—April.

H. W. POTTS.

The late rains have had a good effect on all light soils, and enable the farmer to carry out ploughing and other forms of cultivation to get the land ready for winter crops. It is urgent this season that provision be made for early winter forage crops. The summer crops suffered severely, and in many instances failed through shortage of rain and the prevalence of unusual heat. Maizes, millets, sorghums, and all summer green crops have been checked. To meet the demands for winter food the earlier the crops are sown the better, so as to take full advantage of the germinating conditions created by moisture and warmth now present in the soil; operations should be conducted in the most strenuous and vigorous manner this month.

Wheat.—The greater portion of this crop should be sown this month, and as most of those wheats grown for grain become rusted, it is best to sow the varieties most likely to give good crops of hay. Early hay crops are essential. Blount's Lambrigg, White Lammas, and Bobs have given good returns in the past.

Oats.—These should be sown continuously throughout this month to take full advantage of the favourable weather conditions. Early-sown oats invariably repays fully as it avoids the possibility of rust; this appears in all late-sown crops. It is claimed, and with some grounds, that the best winter forage for cows in milk is oats and peas, or oats and tares. Recent experiments at the College Farm tend to show that the Grey Field Pea germinates well, and provides a heavy crop of green foliage—the yield being up to 9 tons to the acre.

Barley.—The sowing of barley may be continued. Its term of growth is short, especially if we are favoured with occasional showers and freedom from heavy frosts. A light, rich, loose, friable, loam is needed, and a good tilth with liberal supplies of manure. The varieties and quantities described in last month's Notes will be required. Barley is relished by cattle, and when grown with tares or peas, affords a most desirable soiling crop.

Rye.—Whilst it must be admitted that oats or barley provide a more succulent and better fodder than rye, yet it possesses qualities which render it a safe crop to sow for winter feed. It may occupy land totally unsuitable for either of the former crops, and it resists cold better. Both the Saxon Spring Rye and Emerald Rye grow quickly, and give an early cut for winter feeding. It is relished by dairy cattle at a time when succulent, palatable, green feed is scarce. As a grain crop, it provides excellent food for pigs, and the straw is useful as litter. Further, rye is often grown for turning in as green manure.

It may occupy the ground as a catch crop, and prevent the soluble nitrates being washed out of the soil by heavy rains. Seeing it is less exhaustive to the soil than wheat, it may be grown prior to shallow-rooted crops. Care must be observed in all cases to have the rye cut for green fodder before heading, as after that stage it becomes tough and less relishable.

Mangolds and Sugar Beet.—Autumn sowings of these useful roots, although not so prolific as summer sown, afford a succulent feed for cattle and pigs at a time when grass and other green feed is scarce.

Turnips and Swedes.—These may be sown for rotation purposes in preparing the land for maize. The crop can be utilised in two ways; first by marketing the best grown, and secondly by eating off the balance with sheep.

Carrots and Parsnips.—These should be sown for market purposes, as well as stock feeding.

Rape.—Continue sowings of this very prolific forage crop. The value of it as a fodder for pigs has not yet been fully realised, and, given a moist winter, no crop pays so well for sheep and pigs.

Sheep's Burnet.—This crop established a reputation during the last big drought, owing to its power to produce a rich, palatable growth during the driest weather. Its special quality seemed to be its power to stand close cropping. It grows well in winter.

White Dutch Clover, Perennial White Clover (Trifolium repens perenne).—It has been found that this clover is the only one which will survive our trying summer in this district, and holds its own associated with couch. In fact, it is observed that couch retains its succulence and green hue much longer when grown with this universal clover. The fecundation of white clover is largely aided by insects—especially bees. The seed will lie dormant at great depths for a long time, but readily germinates when brought to the surface. Its creeping habit favours its own distribution, and it soon establishes itself from small sowings. During the warm, moist springs here it furnishes a most nutritious and palatable fodder; in fact, all through the winter up to mid-summer it is in evidence, and, unlike other clovers, it is hardy, and resists the encroachment of weeds and harsh grasses. In addition to a tough series of surface fibrous roots, it has the advantage of having a deep tap-root, which penetrates the sub-soil and maintains the plant in healthy vigour during a period of drought. It will thrive on poor soils and may be considered the hardiest of all clovers, and should be more generally adopted in the improvement of our natural pastures. It may be employed in laying down pastures mixed with either Paspalum dilatatum, Texas blue, Rye, Cocksfoot, Prairie, or other introduced grass this month. Apart from its valuable properties in gathering nitrogen and acting as a stimulant to the growth of other grasses, the feed it provides for stock balances the main nourishing qualities of the combined fodders. Every opportunity should be taken this month to lay down pastures in which the growth of White Dutch Clover should form a prominent feature. One pound of seed to the acre will be ample in combination with other grasses; with a fairly wet season it will spread with wonderful rapidity.

HAWKESBURY AGRICULTURAL COLLEGE.

MONTHLY WEATHER REPORT.

SUMMARY for February, 1905.

Air Pressure (Barometer.)			Shade Temperature.				Air Moisture Saturation=100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 13 years.	Lowest %.	Highest %.	Mean %.	Most in a Day.	Total for Month.	Monthly Mean for 6 years.	% of the year's Evaporation.
29·78 23rd.	30·31 10th.	30·05	54·4 11th.	101·5 5th.	71·610	72·137	40 21st.	94 26th.	69	0·425 23rd.	5·134	5·264	11·22

Rainfall...																	
Date ..	1	2	6	12	13	14	15	16	17	18	19	21	25	26	27	Total,	Mean rainfall for 13 years.
Points	$\frac{1}{2}$	3	trace	$8\frac{1}{2}$	$5\frac{1}{2}$	25	47	$\frac{1}{10}$	$11\frac{1}{2}$	$\frac{1}{10}$	1	$\frac{1}{10}$	$2\frac{1}{2}$	$\frac{1}{10}$	trace	1·049	2·345 points.

	N	NE	E	SE	S	SW	W	NW
Wind ..	—	15	3	1	7	5	1	1

Thunderstorms on dates—5, 15, 16, 26.

Greatest daily range of Temperature, 41°·5 on 5th.

Extremes of Rainfall during February, 1896, 0·232 ; 1904, 7·961.

Days on which Shade Temperature rose above 90° Fahr.—4th, 91° ; 5th, 101°·5 ; 11th, 91° 4 ; 12th 96°·2 ; 21st, 92°·6 ; 23rd, 97° 2.

Remarks.—A dry month. Dull, with plentiful supply of moisture in the air. One very bad N.W. wind on 23rd. Temperatures not excessive. Our seventh successive dry month, chiefly remarkable for the number of days (15) on which precipitation occurred, but with very poor results.

CHAS. T. MUSSON,
Observer.

MACARONI WHEATS FOR DISTRIBUTION.

THE Department of Agriculture will be glad to distribute in one bushel lots, seed of the five macaroni wheats, Belotourka, Kubanka, Cretan, Farrer's Durum and Medeah; and would like to see them tried in those parts of our interior where the climate has been found to be rather too dry for bread-wheats. The first four varieties are from Russia and South East Europe, where their flour is used largely, in some places exclusively, for the making of bread. The last is an Algerian variety. The use of the flour of macaroni wheats for bread-making is increasing quickly both in Europe and America, and we have good reason for thinking that at least one Sydney miller will be glad to buy the grain of these wheats for mixing purposes. As macaroni wheats stool sparingly, not less than $1\frac{1}{2}$ bushels of seed ought to be sown to the acre. Applications for seed should be made to the Director of Agriculture, a preference will be given to those which are received from dry districts. Freight to be paid by recipients.

A Few Notes on the Effect of Recent Bush Fires upon Forest Country.

R. L. DAWSON.

RIDING through some of the heavily timbered country devasted by the fierce fires of December 31st last, one cannot help being struck by the extraordinary vitality and recuperative powers shown by most of our forest trees. A couple of weeks after the fires, extensive tracts of forest appeared to be completely destroyed, all the trees, no matter how large, being scorched and withered to the very topmost branches. Now, after a lapse of six weeks, the ground is thickly carpeted with dead leaves and twigs, but the great majority of the trees themselves are bursting into fresh and thick foliage, some of the new shoots being nearly 2 feet long. The stringybarks, bloodwoods, and blackbutts, are the most vigorous. Ironbarks I did not have much opportunity of observing, as they are scarce in the locality visited, but the few I saw are sprouting. Of useful hardwoods the spotted gums seem to have suffered most severely, and, though many are reviving, there are hundreds of beautiful, straight, saplings past recovery, a deplorable loss. The wattles, without exception, seem to be completely killed out, and this represents a severe loss both to the individual and to the State, as it will be at least three or four years before the new growth, which will come rapidly after the fires, will be fit for stripping.

The country visited lies to westward of the main South Coast road, between Moruya and Bateman's Bay, and about 200 miles south of Sydney. If other bark-producing districts have suffered in a similar manner, it will mean a big shortage of tanning material during the ensuing two or three years.

The rapid recovery of the large timber is the more remarkable as the rainfall for the past seven months has been much below normal. Most of the creeks and gullies are dry, and since the fires there has been only about an inch in scattered showers.

Will the late unusual terrible scorching have a future detrimental effect upon our useful marketable hardwoods? It is too soon yet to say for certain, but I noticed that many of the straight young stems are throwing out numerous lateral shoots, owing, I think, to the destruction of the leaves and twigs which has checked the growth at the top. These lateral sprouts may die off when the tops regain their vigour, otherwise the result must be detrimental to the timber, as the trunks, when at a cutting age, will be branchy and knotty instead of smooth.

Analyses of Commercial Fertilisers in N.S.W.

F. B. GUTHRIE AND A. A. RAMSAY.

1905 List.

THE accompanying list of manures obtainable in New South Wales, together with their composition as determined by analysis, and their price, is the result of revision of the list issued in April, 1904. The list is compiled in the interest of the farmers; and it is hoped that it may serve as a guide to those requiring any particular class of manure. In every case the figures given are from samples obtained by an officer of the Department of Agriculture from stock held by the vendors.

A word is necessary in explanation of the column giving the "values" of the manures. These figures are calculated from the composition of the manures as represented by analysis, a definite unit-value being assigned to each of the fertilising ingredients. The units on which the values here given are computed are as follows:—

UNIT-VALUES of fertilising ingredients in different manures for 1905.

	Per unit.
Nitrogen in nitrates...	14s. 2d.
,, in ammonium salts	13s. 6d.
,, in blood, bones, offal, &c.—fine...	13s. 5d.
Phosphoric acid in bones, offal, &c.—fine...	2s. 3d.
Potash in sulphate of potash	5s. 3d.
Phosphoric acid in superphosphate and mineral phosphate—	
Water-soluble	5s.
Citrate-soluble	3s. 6d.
Insoluble ...	2s.

PRICE per lb. of fertilising ingredients in different manures for 1904.

	Pence per lb.
Nitrogen in nitrates ...	7·6
,, in ammonium salts ...	7·2
,, in blood, bones, offal, &c.—fine ...	7·2
Phosphoric acid in bones, offal, &c.—fine ...	1·2
Potash in sulphate of potash ...	2·8
Phosphoric acid in superphosphate and mineral phosphate—	
Water-soluble	2·7
Citrate-soluble	1·9
Insoluble ...	1·1

To determine the value of any manure the percentage of each ingredient is multiplied by the unit-value assigned above to that ingredient, the result being the value per ton of that substance in the manure. For example, a bone-dust contains 4 per cent. nitrogen and 20 per cent. phosphoric acid:—

4 × 13s. 5d. = £2 13s. 8d. = value of the nitrogen per ton.
20 × 2s. 3d. = £2 5s. 8d. = value of the phosphoric acid per ton.

£4 18s. 8d. = value of manure per ton.

It must be clearly understood that the value thus assigned, depending solely upon the chemical composition of the manure, does not represent in all cases the actual money value of the manure, which depends upon a variety of causes other than the composition, and is affected by local conditions. Neither does it represent the costs incurred by the manufacturer in the preparation, such as bagging, labelling, &c. It is simply intended as a standard by which different products may be compared. At the same time, it has been attempted to make the standard indicate as nearly as possible the fair retail price of the manure, and the fact that in the majority of cases the price asked and the value assigned are fairly close shows that the valuation is a reasonable one. To economise space, only those ingredients are given whose presence directly affects the value of the manures. Full analyses can be obtained if desired.

It must be further understood that the figures are in no sense guarantees of the composition of the manures, such guarantee being provided by the vendors themselves, in accordance with the Fertiliser Act now in force.

The analyses are obtained in all cases from samples collected by an officer of the Department, from bulk. It by no means follows, however, that the particular product analysed and here published will be in stock for any length of time.

This remark applies particularly to superphosphates. Anybody purchasing a superphosphate, guaranteed to contain 36 to 38 per cent. phosphates (16 to 17½ phosphoric acid), which is the usual guarantee, must not expect to get 43 to 45 per cent. phosphates (20 to 21 per cent phosphoric acid), although in the sample obtained for the purpose of this list, the higher figure was present.

The difference represents the margin which the vendors find necessary to protect themselves.

Now that the Fertiliser Adulteration Act is in force, the purchaser has only himself to blame if he pays for an inferior article. Every vendor is obliged to furnish a guarantee with every delivery of fertiliser, setting forth its actual composition as determined by analysis.

If the purchaser has any reason to suspect the genuineness of the guarantee, all he has to do is to notify the vendor of his intention to take samples for analysis, in sufficient time to enable the vendor or

some person appointed by him to be present. The samples must be taken before the consignment is finally in the purchaser's possession, for example, if the fertiliser is sent by rail the sample should be taken at the railway station or siding. Three samples must be taken, one being given to the vendor or his representative, the second kept by the purchaser and submitted to an analyst, and the third forwarded to the Department of Agriculture for future reference, in case of divergence in the analyses of the other two. All three samples must be sealed up.

With regard to Part II (Bone-dusts, &c.), it will be observed that the state of mechanical division of these is given as "fine," "medium," and "coarse." "Fine" is the portion which passes through a sieve of 50 linear meshes to the inch, "medium" is the portion passing through a sieve of 12 meshes to the inch, but retained on the 50-mesh sieve, and "coarse" is the portion retained by the 12-mesh sieve.

The valuation has been made irrespective of the fineness of division, and is based on the amounts of fertilising ingredients only; but it must be borne in mind that finely ground bone-dust acts more rapidly than coarse, and that unground fragments of bone only become available as fertilisers very slowly.

In the table of mixed fertilisers, &c., it will be noticed that three columns are assigned to phosphoric acid, and a different unit value assigned to each—water-soluble, citrate-soluble, and insoluble. When bones or mineral phosphates are acted on by sulphuric acid, a portion of the tricalcic phosphate is converted into another lime compound, known as monocalcic phosphate or superphosphate. This compound is soluble in water, and it is to its presence that the rapid action of the phosphate is due. This is the "water-soluble" acid of the table. In many superphosphates, however, a considerable portion of this compound has undergone change. This change may be due to the salts of iron and alumina present, or to the length of time it has been kept, and it results in the formation of a third lime compound, bi-calcic phosphate. This is known as "reverted" or "retrograde" phosphoric acid, and being insoluble in water, but soluble in ammonium citrate, is here given under the heading of "citrate-soluble." A value has been assigned to the phosphoric acid in this condition intermediate between the others. Its manurial activity has been found to be very little less than that of water-soluble acid.

As many manure manufacturers prefer to use the term "reverted," it is well to keep in mind that in this list the term is identical with "citrate-soluble."

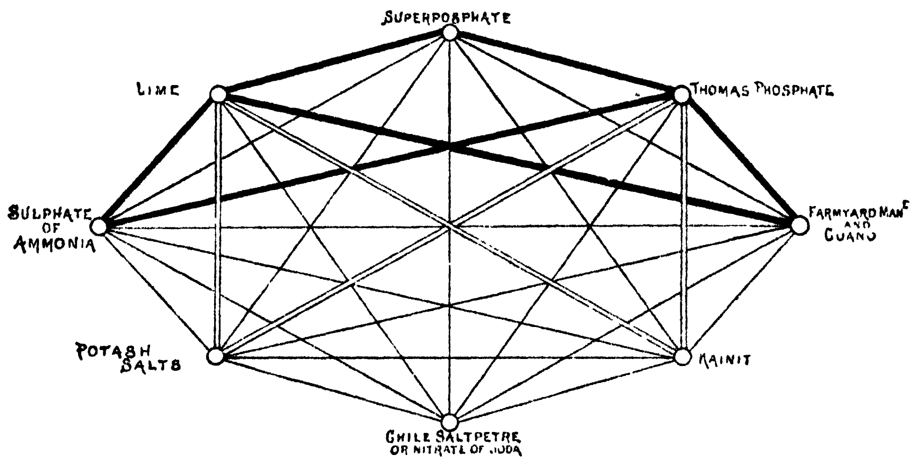
In the fourth table are a number of waste products which may in many cases be economically utilised.

WHEN purchasing a manure always insist on a guarantee of its composition as determined by analysis.

Artificial manures should be mixed with about three times their weight of dry loam, and distributed evenly.

Never add lime to a manure containing sulphate of ammonia or blood and bone manures, as in these cases loss of nitrogen results; and when lime has been applied to the land do not use such manures until about three weeks afterwards.

The accompanying fertiliser diagram, which represents in a graphic manner the points to be taken into consideration in the mixing of different manures, is reproduced in the hope that it will be found useful to farmers who make up their own mixtures. The diagram originates with Dr. Geekens, Alzey, Germany, and is taken from an article by Mr. Leo Buring in the *Garden and Field* of 10th October, 1903.



Substances connected by thick line must not be mixed together.
Substances connected by double line must only be mixed immediately before use.
Substances connected by single thin line may be mixed together at any time.

I.—Simple Fertilisers.

Manure.	Where obtainable.	Nitrogen.	Equivalent to Ammonia.	Lime.	Potash (K_2O).	Phosphoric Acid.	Value. £ s. d.
Sulphate of Ammonia...	Australian Gaslight Co.	20·93	25·42	......	......	......	14 2 7
Nitrate of Soda...	Gibbs, Bright, & Co., 37, Pitt-street	15 58	18·92	......	......	......	11 0 9
Sulphate of Potash	R. S. Lamb & Co., 55, Pitt-street	......	......	......	49 04	......	12 17 6
Nitrate of Soda...	" "	15·41	18·75	......	......	......	10 18 9
Sulphate of Ammonia	" "	20·66	25·09	......	......	......	13 18 11
Sulphate of Potash	Geo. Shirley & Co., 52 and 54, Pitt-street	......	......	......	52·13	......	13 13 8
Sulphate of Ammonia	" "	21·00	22·50	......	......	......	14 3 6
Lime	Sydney and North Sydney Lime and Cement Co., 279, George-street.	......	......	85·68	......	......	....
Kainit	Paton, Burns, & Co., Commercial Chambers, corner of Sussex and King Streets.	......	......	......	13·84	......	3 12 8
Sulphate of Potash	" "	......	......	......	52·58	......	13 16 0
Nitrate of Soda	" "	15·38	18 68	......	......	......	10 17 10
Gypsum...	" "	......	......	92·67 (Crystallised $CaSO_4$.)	......	......	......
Phosphate Powder	" "	......	......	......	......	18·08*	1 18 2
Sulphate of Potash	A. Wooster, Epping	......	......	......	52·96	......	13 18 0
Nitrate of Soda...	Elliot Bros., Balmain	15·58	18·92	......	......	......	11 0 9

Note.—Lime, £1 per ton, and agricultural lime, 10s. per ton, on trucks at Portland. Agricultural lime is screenings from building lime, and is not slacked.

* Of which ·33 is water soluble and ·71 is citrate soluble.

II.—Bone and Blood Manures.

Manure.	Where Obtainable.	Moisture.	Volatile and Organic Matter.	Insoluble Matter.	Nitrogen.	Equivalent to Ammonia.	Phosphoric Acid.	Equivalent to Tri-calcic Phosphate.	Mechanical Condition. Percentage of— Fine.	Medium.	Coarse.	Value. £ s. d.
Bone-dust	M. O'Riordan, O'Riordan's-road, Alexandria.	6·78	39·66	2·25	6·97	8·46	21·88	47·77	38·4	58·6	3·0	7 2 9
,, B.D. 1 ..	Paton, Burns, & Co., Commercial Chambers, corner Sussex and King Streets.	7·21	31·13	2·76	4·77	5·79	24·59	53·68	35·0	64·0	1·0	5 19 4
,, B.D. 2 ...	,, ,,	6·39	35·67	·78	4·56	5·54	24·23	52·90	42·2	56·6	1·2	5 15 8
,, B.D. 3 ...	,, ,,	5·70	38·10	2·53	4·15	5·04	22·95	50·11	43·4	54·6	2·0	5 7 4
,, B.D. 4 ..	,, ,,	6·51	36·13	2·71	3·89	4·72	23·09	50·41	51·0	56·8	2·2	5 4 2
Nitrogenous bone-dust	,, ,,	8·76	65·06	3·20	9·81	11·91	8·95	19·54	24·0	74·0	2·0	7 11 9
Bone and blood, B.B....	,, ,,	5·18	48·31	1·26	5·32	6·46	19·54	42·67	38·0	62·0	nil.	5 15 4
Nitro	,, ,,	9·32	78·75	6·71	6·80	8·26	1·21	2·64	30·0	70·0	nil.	4 13 11
Bone and blood, B.B....	Sydney Soap and Candle Co., Kent-street.	6·91	47·04	·47	5·71	6·93	19·43	42·43	28·8	71·2	nil.	6 0 4
,, ,, ,, ...	R. S. Lamb & Co., 55. Pitt-street.	6·00	44·10	6·46	5·11	6·21	17·95	39·20	36·6	62·4	1·0	5 8 11
Bone-dust, A 1 ...	,, ,,	4·66	34·78	6·88	3·60	4·37	19·74	43·10	61·0	39·0	nil.	4 12 9
Steamed bone-dust ..	,, ,,	5·55	32·09	·88	4·01	4·86	26·30	57·43	60·0	40·0	nil.	5 13 0
Raw bone-dust ..	,, ,,	5·73	34·62	1·26	4·01	4·86	24·86	54·28	34·3	65·7	nil.	5 9 9
Bone flour	,, ,,	4·36	35·71	2·46	3·39	4·11	23·33	50·93	100·0	......	......	4 18 0
Bone-dust digested, 40 per cent.	Co-operative Wholesale Soc., 36–37 Royal Exchange.	5·85	34·25	5·49	4·29	5·20	19·79	43·21	56·5	43·5	nil.	5 2 1
Digested bone-dust, No. 2.	,, ,,	5·35	33·28	3·42	4·56	5·53	25·06	54·72	55·5	44·5	nil.	5 17 7
Special fertiliser, No. 3	,, ,,	3·52	47·34	1·37	5·11	6·20	19·00	41·50	46·5	53·5	nil.	5 11 4
Pure steamed bone-dust	A. Wooster, Epping... ...	7·97	30·86	1·69	3·87	4·69	25·40	55·45	30·0	70·0	nil.	5 9 0
Bone and blood, B.B....	,, ,, ...	11·77	37·41	4·05	4·70	5·70	18·24	39·82	42·0	58·0	nil.	5 4 1
Nitrogenous bone-dust, B.D. 4.	,, ,, ...	10·73	43·17	3·50	6·28	7·62	17·95	39·20	44·0	56·0	nil.	6 4 8
Green bone-dust ...	,, ,, ...	9·21	30·91	·97	4·01	4·86	25·13	54·86	23·0	75·0	2·0	5 10 4

III.—Superphosphates, Mixed Fertilisers, and Imported Fertilisers.

Manures.	Where obtainable.	Nitrogen.	Equivalent to Ammonia.	Phosphoric Acid. Water soluble.	Phosphoric Acid. Citrate soluble.	Phosphoric Acid. Total.	Potash.	Value. £ s. d.
Ohlendorff's Dissolved Peruvian Guano.	Gibbs, Bright, & Co., 37, Pitt-street	5·94	7·21	10·25	1·28	13·46	1·08	7 5 4
Superphosphate No. 1 ..	Paton, Burns, & Co., corner King and Sussex Streets..	......	......	21·61	·32	22·42	......	5 10 2
Superphosphates No. A1	Geo. Shirley & Co., 52 and 54, Pitt-street	......	......	21·94	·48	22·77	......	5 12 1
Superphosphates 1	,, ,, ...	......	......	17·86	·07	18·29	......	4 10 3
Superphosphates 2	,, ,, ...	1·99	2·42	13·62	·36	14·20	·95	5 1 8
Superphosphates 3	,, ,, ...	3·57	4·34	11·14	·46	13·69	2·10	6 0 8
Superphosphates 5	,, ,, ...	3·95	4·80	11·45	·54	13·55	7·68	7 15 11
Superphosphates 9	,, ,, ...	4·08	4·95	9·57	·19	10·11	3·12	6 0 8
Superphosphates 12	,, ,, ...	4·17	5·06	10·35	1·95	19·25	1·65	7 0 3
Superphosphate	R. S. Lamb and Co., 55, Pitt-street . . .	.....	......	21·30	·95	22·65	......	5 10 8
Bone-dust and Superphosphate.	A. Wooster, Epping	3·81	4·63	2·20	......	22·09	......	5 6 11
Complete Fertiliser ...	,, ,, ...	4·56	5·54	1·15	5·76	15·35	3·13	6 5 11
Coco-nut Oil Cake ..	Lever Bros., Balmain	3·21	3·90	......	.. ...	1·21	1·84	2 15 5

IV.—Waste-Products, Ashes, &c.

Manure.	Where obtainable.	Water.	Volatile and Combustible.	Nitrogen.	Ammonia.	Insoluble	Lime.	Phosphoric Acid.	Potash.	Value.
										£ s d.
Deposit from wool-scouring tanks. (1	Liverpool Wool-scouring Works.	...	...	·64	·78	...	...	...	·72	0 12 4
,, (2	,, ,, ,,	...	...	1·02	1·24	...	...	·16	·39	0 16 1
,, (3	,, ,, ,,	...	...	1·37	1·66	...	...	·14	·20	0 19 9
Deposit from breakers ..	,, ,, ,,	34·47		1·81	2·20	50·68	·85	·88	1·60	1 14 8
Sediment from wool scouring works.	Yass ..	19·57		·59	71	78·24	·97	....	·20	0 9 0
Wool-waste ..	...	...	...	8·15	9·80	...	...	...	...	5 9 4
"Skutch" from limed pelts	Hugh Wright, Auburn ..	5·32	73·42	1·30	2·18	3·61	9·36	·89	·20	1 7 2
Decomposed hair and lime	Fellmongery ..	9·70	57·08	6·86	8·33	1·22	26·27	...	...	4 12 0
Tan-yard refuse ..	Tanneries, St. Marys ..	6·43	33·83	2·24	2·72	21·43	26·[illegible]6	·67	...	1 11 7
Filter-press muck ..	Cane-mills, Broadwater .	16·39	26·07	·22	·27	34·86	13·20	5·98*	·44	1 12 3
Megass ..	Clarence River cane .	22·86	67·32	·63	·78	8·61	·30	·01	·05	0 8 9
Megass-ash ..	,, ,,	...	...	...	...	87·69	3·07	·16	·51	0 3 1
,, ..	Richmond ,,	...	...	...	...	...	1·11	·28	4·79	1 5 9
Bloodwood-ash ..	...	...	...	...	...	...	8·47	·27	5·25	1 8 2
Ironbark-ash .	...	...	...	...	...	...	...	·82	1·53	0 9 11
Blackbutt-ash ..	...	...	...	...	...	...	7·27	·04	2·02	0 10 8
Red-gum-ash ..	...	...	...	...	...	...	...	·38	4·17	1 2 9
Spotted-gum-ash ..	...	...	...	...	...	...	...	·10	·70	0 3 11
Boxwood-ash ..	...	...	...	...	...	...	...	·67	1·65	0 10 2
Sea-weed-ash .	...	...	...	...	...	...	9·27	·49	·59	0 4 2
Sea-weed-ash	...	...	...	...	...	...	6·29	1·27	17·55	4 15 0
Ash of grass-tree (*Xanthorrhœa arborea*).	...	0·86	1·78†	...	...	33·48	24·94	3·07	5·30	1 14 9
Vine-cuttings-ash ..	...	·49	...	...	...	60·64	11·34	1·85	3·76	1 3 11
Red-apple-ash ..	...	...	...	...	...	54·52	14·96	0·47	6·00	1 12 7
Ash of kerosene shale ..	Hartley Vale ..	1·49	27·93	·70	·85	67·59	...	·28	·14	0 10 4
She-oak-ash ..	...	...	...	...	...	8·57	42·35	8·85	2·19	1 11 5
Sea-weed, fresh state ..	...	80·00	...	·16	...	...	·41	·09	1·18	0 8 7
Sawdust ..	...	32·52	62·35	·82	1·00	...	...	1·70	·05	0 15 1
Cave-deposit, shells, &c. ..	Cowan, Hawkesbury River	2·11	...	·82	·99	...	35·40	1·59	·88	0 19 2
,, ..	Macleay River ..	23·06	16·01	2·43	2·95	26·77	13·88	7·40	...	2 9 3
Gypsum ..	Marulan ..		(Crystallised $CaSO_4$ = 92·64.)			4·47	...	...	...	...
Flue-deposit ..	Maitland ..	...	...	...	...	83·75	2·56	·32	·31	0 2 4
,, ..	Liverpool ..	...	...	...	...	91·17	·42	1·29	·17	0 3 10
,, from sanitary furnace	...	...	...	...	...	63·53	6·64	1·82	1·61	0 12 7

* 5 per cent. soluble in water. † Unburnt carbon.

IV.—Waste-Products, Ashes, &c.—*continued.*

Manure.	Where obtainable.	Water.	Volatile and Combustible.	Nitrogen.	Ammonia.	Insoluble.	Lime.	Phosphoric Acid.	Potash.	Value.
										£ s. d.
Night soil mixed with lime	....	44·33		·74	·89	18·60	27·62	·78	...	0 11 8
Night-soil	Wagga Wagga	6·70		·03	0·4	82·19	·44	·28	·69	0 4 8
"	"	9·14		·28	·34	78·92	1·18	·18	·54	0 7 0
"	"			·50	61			·64	·62	0 11 5
" preparation, No. 1 (*a*)	"	8·22		3·73	4·63	50·22	13·32	9·65	·91	3 16 6
" " No. 2 (*b*)	....	7·20		1·83	2·22	29·02	6·05	4·10	·15	1 14 7
" " No. 3 (*c*)	....	25·95		1·64	1·99	60·17	1·39	1·61	·70	1 9 4
Night-soil preparation, "Pinhoe" manure.	....	·92	9·54	·21	·25	57·58	14·71	1·26	·56	0 8 7
Night-soil preparation, No. 1	F. Artlett, Parramatta	7·33	30·08	2·10	2·55	46·38	3·74 $CaCO_3$	1·92	·61	1 15 8
" "	" "	10·11	42·59	4·97	6·03	·94	30·12	·39	......	3 7 7
" "	Mr. Halstead, O'Brien's patent.	1·54	12·36	·54	·65	77·95	......	·63	......	0 8 8
Farmyard-manure	....	67·96	22·09	·40	·49	8·16	·16	·20	·30	0 7 5
Fowl-manure	....	3·95	16·48	1·47	1·78	70·16	2·10	1·94	......	1 4 1
"	....	1·54	15·23	·86	1·04	79·96	·64	·59	·33	0 14 7
Flying-fox-manure	....	1·09	35·34	3·34	4·05	50·29	1·02	0·36	1·15	2 11 8
Fish-manure	....	10·88	59·26	6·10	7·40	5·39	9·82	8·28	......	5 0 6
Sheep-manure	Liverpool Wool-scouring Works.	9·71	50·91	1·79	2·17	32·26	2·0	·91	·92	1 10 11
Bat-guano	....	14·11	17·69	1·55	·88	28·77	13·72	11·42*	......	2 9 3
Bat-guano†	....	10·86	19·65	2·24	2·72	51·95	1·75	3·55	·15	1 19 8
Bat-guano‡	....	13·70	34·35	4·76	5·78	3·30	22·28	13·04	trace	4 14 6
Bat-deposit	Cave Flat, Cooradigbee	5·43	12·98	·59	·61	57·64	5·60	12·12	......	1 14 0
Decayed wood (bark and leaves), bloodwood.	....	57·80		·74	·89	40·68	1·30	....	....	0 9 11
Decayed wood (bark and leaves), pepper tree.	....	79·92		·89	1·08	17·77	1·50	....	....	0 11 11
Muck from waterworks reservoir	Maitland	4·84	17·56	·74	·90	63·42	4·56	·31	·69	0 13 9
Cocoa-nut cake	Lever Brothers	8·71	85·37	3·45	4·15	....	1·40	1·23	2·45	3 1 11
Bean-cake	North China	14·52	80·32	6·77	8·22	...	...	1·33	1·99	5 4 3
Field-pea, whole plant	....	83·58	9·97	·55	·67	.	·15	·12	·49	0 10 3
Tares, whole plant	....	83·07	14·96	·73	·88	...	...	·11	·21	0 11 2
Marsh-mallow, whole plant	....	79·00	17·86	·85	1·08	....	....	·14	·69	0 15 4

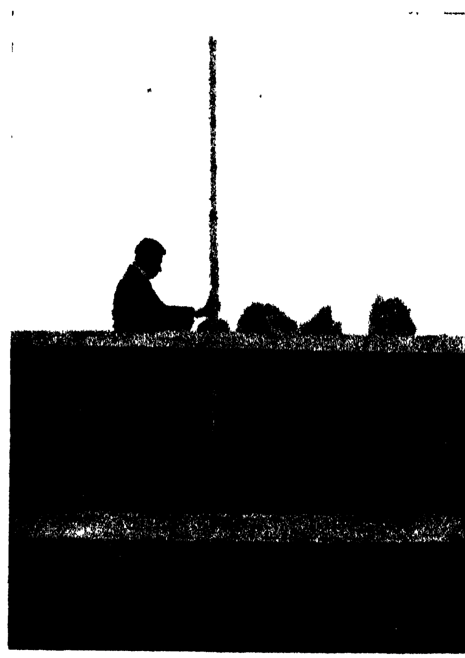
* 1 per cent. of the phosphoric acid is water-soluble. † The total nitrogen contains 1·12 nitric nitrogen, ·84 ammoniacal nitrogen, ·28 organic nitrogen. ‡ This analysis was made by Mr. J. C. H. Mingaye, and the total nitrogen contains 1·70 nitric nitrogen, ·64 ammoniacal nitrogen, and 2·42 organic nitrogen.

a 4·86 per cent. phosphoric acid is water-soluble. *b* 3·03 per cent. phosphoric acid is water-soluble. *c* ·42 per cent. phosphoric acid is water-soluble.

Effect of Irrigation at Newington and Parramatta Asylums.

In the middle of September, about 6 acres of naturally inferior ground, containing a large quantity of ironstone, was sown broadcast with Hickory King Maize, to be cut for ensilage. There was just sufficient moisture in the soil, after it had been twice ploughed and harrowed, to germinate the seed. When the plants had grown to about 9 inches in height, the water was turned on by means of the furrow system, and in all about 4 acres were treated in this manner, with

Maize—Irrigated.

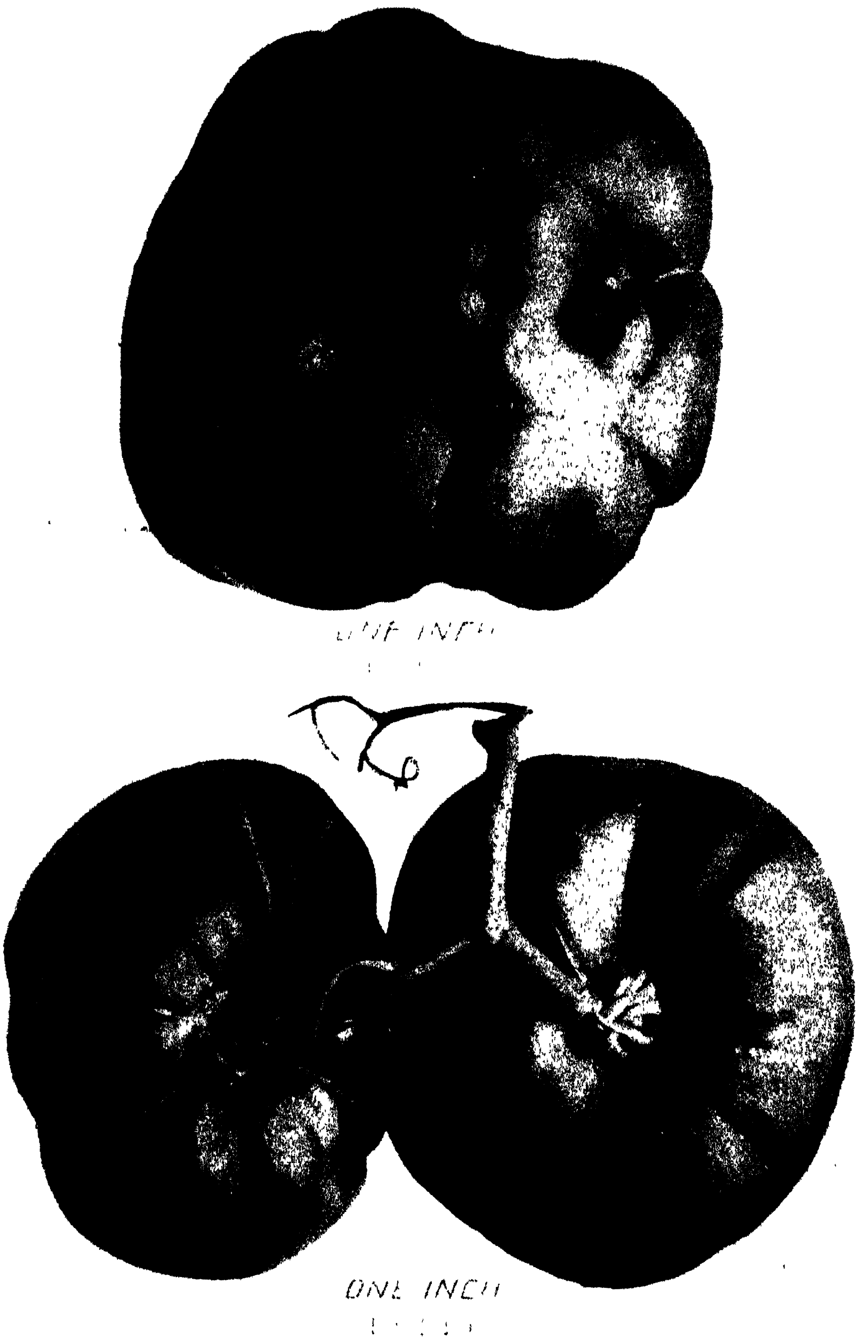


Maize—Not irrigated.

Newington Asylum.

the result that at the time of cutting, which took place on the 28th December, the crop irrigated would average 8 or 9 feet in height, with a good growth of flag.

The accompanying photographs were taken on 10/12/'04, and during the whole period this crop was growing, there was practically no rainfall, although a few thunderstorms threatened, but passed off after a few drops had fallen. On the area not irrigated (about two acres), the crop averaged about 2 feet in height, and was almost



Tomatoes grown at Parramatta Asylum under irrigation.

dried up; but it was cut and chaffed and put into the silo with the crop from the irrigated portion. The irrigation plant consists of a Blake pump, with a 2-inch suction and delivery, and the source of the water-supply is a dam cut at the foot of a gentle slope, fed by the the surface water and drainage only. The storage capacity is about 800,000 gallons.

The three tomatoes shown here were grown at Parramatta Asylum, on poor soil, which for this crop received no special treatment, except a plentiful supply of water. The inch measure was photographed at the same time, this will give some idea of the size of the originals. Some of the tomatoes weighed 31 oz., and were of the Crimson Cushion variety.

Rabbit Destruction.

H. C. PALMER,
Inspector of Stock, Germanton.

One of the most important questions, if not the most important question, now engrossing the attention of landholders, large and small, in many districts in this State, is rabbit extermination, or at all events keeping this pest within bounds.

Each district has its own peculiar features, all of which render different methods of destruction necessary, and in the same way, what will prove successful in one part of a district will be considered valueless in places only a few miles distant. Wire netting on fairly level country splendid means of keeping bunny within bounds; but in broken country this is impossible. Poisoned water, again, is a wholesale means of destruction, where water is only obtainable in tanks; but where water is abundant this destroyer is valueless. So that it may be taken for granted that in many districts where the country is too rough for even poison carts to work, rabbits have come to stay. The use of poison, too, is working—no one can say what evils. Valuable birds and reptiles are becoming almost extinct, and no one knows what far-reaching evil this may mean; and continually losses occur from stock and poultry being poisoned. It will be generally admitted, then, that poison, even where taken freely and easily laid, is not altogether satisfactory. Trapping, too, has its drawbacks, for trappers naturally do not desire their occupation to cease, and the unsaleable rabbit is often allowed to live, and increase and multiply; but it is generally admitted, in the winter months and where railways are within reach, rabbits are reduced in numbers to such an extent as to render them harmless. This being so, in the *winter* months *near railways*, it follows that if the necessary requirements of temperature and facility for reaching a market can be provided in the *summer* months, rabbit trapping should prove equally as effective during the *summer*, over a larger area.

Private enterprise, having for its object, a return as large as possible for the capital expended, and not so much the keeping the rabbit pest within bounds, cannot be expected to take risks, where large profits are not very apparent; but with a public body, dealing with public funds, which exists only for the purpose of dealing with this public nuisance, and not seeking profits from the capital expended, other than the realising of the object for which it exists, namely, the destruction of rabbits, the case is different. Section 18, Part 2, of the Pastures Protection Act provides for an assessment on stock and land to be struck; and section 30, Part 3, provides for the expenditure of these funds in the purchase of machinery, plant, or substance for the destruction of rabbits, and also for the loan of money at 5 per cent., repayable over a term of twenty years. My suggestion, therefore, is that part of the funds collected under section 18, be expended in the purchase of plant and machinery, under section 30. The plant and machinery consisting of small refrigerating stations, distributed at convenient places over the district. I have obtained an estimate of the cost, which is £350, including building, to cool 600 cubic feet to thirty-seven degrees. A motor car, to carry 2 tons at from 10 to 15 miles per hour, can be obtained for from £800 to £1,000; thus, ten cooling chambers and a motor car could be provided for £5,000, or less, which, at 5 per cent., would mean £250 per annum. The cost of working each of the refrigerating chambers for the six months during which it would be necessary to use them, would be about £50, and the cost of running the car for 12 months would be, say, £150. So that the whole thing could be run for £900 per annum, and this amount should be repaid to the Board by the trappers; so that, if the interest on plant and working expenses were in that way returned, the aim in view would be accomplished, and would be self-paying; but, if this result were never realised, I am of opinion that the benefit derived would be cheap at £900 per annum. If a regular supply could be obtained a cannery, or refrigerating works, or both, would be established by private enterprise, and a valuable commercial product would be made out of what is now a pest. My object in writing is to invite criticism and stimulate thought on this most important subject. The annual cost to holders for the destruction of rabbits is a very serious item, and if the annual rate levied under the Act can be made to relieve landowners of that expense, wholly, or in part, and at the same time find employment for a large number of hands, it is surely worth consideration.

Improvement and Settlement Lease Conditions.

W. MACDONALD.

I WILL take the liberty of suggesting that the conditions with regard to the preservation of timber might be more liberally embodied and made compulsory. The indiscriminate destruction of ironbark is a very serious matter, and there are leases in my district which contain the narrow-leaved variety of this valuable timber in considerable belts. The saving clause under the ordinary gazette-slip conditions reads as follows:—*The lessee shall carefully preserve all straight and sound ironbark and pine over 6 inches in diameter at 3 feet from the ground.* The words *straight* and *sound* are too vague and ambiguous. An ironbark-tree may be very useful though neither straight nor sound. I have often seen crooked and hollow trees from which two straight cuts of rail-sleepers were taken of the very best quality. It also appears that a straight young tree or sapling of any size should not be destroyed except under the most careful supervision of thinning out. I am of that opinion that ironbark and grey pine in this district should be exempted from ringbarking operations owing to its comparitive scarcity, and the impossibility, under ordinary ringbarking limits, of exercising the necessary supervision and discrimination. I include the silver-leaved ironbark in this connection because, in the first place, it has proved a useful fodder in periods of drought, and, secondly, it generally forms open forests such as are not detrimental to the growth of grass. I am acquainted with what was a few years ago a pretty open forest of this timber, thickly grassed, and a favourite pasture for cattle. The timber is now all killed by ringbarking, the ground does not produce any more grass than it did before, it dries up very quickly, and it is remarkable that cattle now avoid these cheerless ridges which was once their favourite pasture. It is, therefore, obvious that while some forests may be highly improved by ringbarking there are others which may not. In the northern and north-western portions of my district, on the watershed of the Macintyre, Dumaresq and Barwon rivers, there are dense belts of brigalow and belar, chiefly held under improvement leases (sec. 26, 58 Vic., No. 18). Such forests will make valuable grazing farms if properly dealt with, but the wholesale slaughter of timber which is carried on in many instances must prove seriously detrimental to incoming tennants. In the Gilgai portions of these forests, where the soil is rich and subject to the high-flooded overflow of the rivers, the brigalow and belar attain heights of from 40 to 60 feet with clean straight stems of 20 to 30 feet, and a diameter of 10 to 15 inches at 3 feet from the ground, averaging upwards of 200 trees per acre, irrespective of wilga wild orange, cherry, boomery, whitewood, and other varieties o

edible trees and undergrowth on which stock would live for a long time with plenty of water, such forests, in many places, are also clothed with luxuriant varieties of salt-bush, the growth of which is not retarded by the density of the timber, but on the contrary it flourishes and remains fresh and green when all vegetation on the treeless plains and ringbarked portions is parched and dry. It therefore appears that such forests do not require to be ringbarked—gathering up and burning off of the deadwood on the ground would be a much more practical and economical method of improvement. It should also be considered that belar is an excellent fodder to fall back upon in seasons of drought, being quite equal to river oak, and known to have saved thousands of sheep and cattle; had water been obtainable in the belar forests during the late drought, and the belar, with other edible foliage, properly utilised, the losses in stock would not have been half so great. There is another feature which should not be lost sight of in this connection, namely, the inestimable value of such forests as fire-breaks and shelter-belts which should be liberally provided for on every holding where practicable.

In view of the many object lessons revealed to us in the shape of natural landscapes of plain, beautifully interspersed with belts and groups of timber under which we find cattle or sheep quietly camping, sheltered from flies and the glare of the sun in summer, or the cold in the winter, and the appreciation of such scenery to the traveller after having passed over miles of treeless plain, it is difficult to understand the lamentable want of discrimination and taste too often displayed in connection with ringbarking and clearing of land.

Hard Seeds.

M. DENAIFFE,
Journal de l'Agriculture.

We designate as hard those seeds normally constituted and ripe, but which remain inactive in the seed-beds, although placed in under the most favourable conditions for sprouting.

In order to leave no doubt as to the exact meaning of this word we must give a few explanations on the subject. The ripeness of the fruit and the ripeness of the seed must not be confounded, as they are two very different physiological facts, and do not always occur simultaneously. There is no direct connection between them, as sometimes the seeds ripen first, sometimes simultaneously with the fruit, but more often later than the fruit.

A seed is ripe when its contents (starch, sugar, &c.) have arrived at such a state that they can be assimilated by the embryo as soon as the seed comes into contact with exterior moisture, oxygen, and heat, which are the three principal and necessary conditions for its

germination. Hard seeds are met with among many forage plants, principally in the leguminous ones, particularly clover, lucerne, sulla, and various kinds of vetches, &c.

Much difference exists between hard seeds and seeds which have lost their germinative power, either by age or a defective conformation, &c. The first remain with a latent or retarded vitality, whilst most of the others are dead.

When placed in an experimental seed-bed the one lot shows scarcely any appreciable change, whilst the others soon begin to swell, change colour and appearance, become mouldy, and rot. Thus from a practical point of view a very great difference is found in these two kinds of seeds, because the hard ones have not lost their germinative faculty, and when put into the soil the majority grow, though sometimes only after a long period of inaction.

For this reason the seed-control stations of the State consider the hard leguminous seeds as being good; at any rate they will germinate, whilst a very large proportion of the others will not sprout. A high percentage of hard seeds have the undesirable feature of sprouting too slowly at the beginning, thereby causing loss of time, and many experiments have been made to obtain by special treatment a quicker and more uniform development.

This hardness being due to the impenetrability of the outer skin of the seed, which prevents the entrance of moisture, all that is necessary to create a partial if not total germination is to facilitate the access of moisture to the kernel, either by an incision or by softening the skin.

About fifteen years ago a process of steeping the seeds in boiling water for five minutes or more was tried, but was not found a success on account of the difficulty of regulating the different periods of immersion for different seeds.

Lately several machines have been constructed for making an incision in the skin without damaging the kernel, so as to obtain a uniform germination of fresh seeds. The Experimental Station of Svalöff in Sweden has had an apparatus specially constructed for this work. These machines have so far been principally used for clover seed, and the work consists simply in exercising such a pressure on the skin as will crack it. Clover seed thus treated germinated at the rate of 90 per cent. in about twenty-four hours. Several large seed merchants in the North of France are selling clover seeds which have passed through these special machines. At first the sales were very limited, as most agriculturists seem to attach little or no importance to the matter, but now, in consequence of the excellent results obtained, the merchants sell more than half of their clover seeds thus prepared.

Report of the Trial of Seeds at Norfolk Island.

E. S. MAYNE,
Melanesian Mission, Norfolk Island.

GRASS seeds were sown on well worked land, last April and May, and the land has been mowed with the reaper, and in later time stocked with calves or sheep, turned on for a few days at a time. The season has been wet and favourable for growth, but weeds have been unusually troublesome. Cultivation is very difficult owing to the large collection of weeds, as Mr. Maiden bears testimony in his report. One would think every convict sent here brought a special weed to spite the Government.

In April, Paspalum Dilitatum, Danthonia Semiannualaris, Bromus Inermis, Poa Pratensis, Chewing's Fescue, Indian Doab, Prairie, and the three grasses supplied by you (only a few plants of one variety, Plum Grass, came) were sown in well-prepared land, in rows, 2 feet apart. Of these, Bromus Inermis, Prairie grass, and the Couch grasses came well, but Prairie grass will not stand feeding here. The rest either failed completely, or just a few plants grew. In August, Rye grass, Cocksfoot, Danthonia Semiannualaris, Paspalum Dilitatum, Poa Trivialis, Couch, Poa Pratensis, were tried in the same way. Rye grass, Cocksfoot, Paspalum and Poa Trivialis came well, but only the Paspalum and Cocksfoot have grown well, the rest failed.

In the autumn, about 4 acres were sown with Chewing's Fescue, part of the land being sown thinly with oats or rye, and in the same paddock three half-acre lots in Paspalum Dilitatum, Danthonia Semiannualaris, and Bromus Inermis. The Chewing's Fescue failed, as also the others except Bromus Inermis, which is thin.

Surface sowing was tried, as soon as the drought broke up in the autumn, with a mixture of almost all these grasses, and a small proportion of all clovers used in the north of New Zealand, as well as 12 lb. of Bokhara clover. Some of the clovers came, most noticeably Bokhara, and some red and white. But so far the grasses hardly show, a very small percentage having grown, and that mostly in the shade of trees, but it is possible to find plants of almost all the varieties sown. Paspalum Dilitatum plants, planted at the same time, have done well and seem to stand feeding remarkably well.

About an acre of sheep's burnet has grown very well, and about the same of lucerne, but it is too early to tell how it will stand, though looking fairly well.

About 2 acres were sown with cowpeas, Wonderful, Black, White, and Upright. The White failed, and the Upright were very small, the other two varieties grew stronger, though small.

Pearl millet failed. Rape and mustard, though planted in the autumn, winter, early and late spring, were taken by insects.

Field peas grew well.

French millet went very early to seed and was very short.

Hungarian millet grew splendidly.

Sorghums, Early Amber Cane and Planter's Friend have grown splendid crops, and of all things tried have done best on worked-out land.

Rye made fair winter and spring feed.

Oates and barley grew unusually well, and also maize.

Of the maizes, Riley's Favourite and Clark's Early Mastodon filled well. Red Hogan and Hawkesbury Favourite fairly. One other kind, the name I did not enter, yielded a splendid crop and seems far the best for ensilage.

Experimental Beans.—Tongan Bean, very strong grower and climber, covered a fence 2 yards away from the row. Florida Velvet Bean only grew moderately. Soy Beans did not germinate. Tangier Peas came, but were very small.

All the experimental seeds were sown on only moderately good ground, to test their use for feed, or for green manure on land which required enriching.

The seasons vary so much here that these experiments give only a partial idea of the value of plants, and I hope to continue them on slightly different land under altered conditions.

The experimental grass seeds were kept as clear as practicable by mowing to test their value for sowing in pastures.

We also tried seeds of Australian Hardwood Timber Trees, but the four varieties tried failed.

HAY-MAKING.

IN a paper read before the Riverton Branch of South Australian Bureau of Agriculture, reported in the *Agricultural Journal*, Mr. H. H. Davis, says:—

To grow good hay it was quite as necessary to fallow and work the land well as for a wheat crop; in fact, more so, as weeds that will not injure the sample of grain will be gathered by the binder, and will greatly deteriorate the quality of hay. Many farmers cut their lightest crops for hay; this, in his opinion, was a great mistake. A crop that will cut only 10 cwt. of hay will often yield 10 bushels of wheat; whereas a heavier crop may go 30 cwt. to 2 tons per acre, but will yield only 15 bushels. The heavier crop will pay better to cut for hay, besides yielding a better quality article; besides, if the heaviest crop is cut for hay there is less risk of loss from rough weather. It is difficult to say which was the best wheat for hay, as they were often uncertain what they would cut until haymaking time arrived. They must, therefore, select good all-round wheats, and, in his opinion, Majestic, Marshall's No. 3, Petatz Surprise, Gluyas, and King's Early were among the best. For hay alone the Purple Straw, Tuscan, and other old varieties were better, as they kept a better colour when well

on to maturity than did the present white-straw wheats. If the land is dirty with oats, an early variety must be grown. He liked to sow quickly—with early wheats 1¼ bushels to 1½ bushels per acre, and not less than 1 bushel of the better stooling varieties. For a hay crop he preferred to drill in the manure about March or April, and broadcast the seed later on. From 5 cwt. to 6 cwt. per acre more hay will be obtained than when sown in drills, and the crop is much easier to cut with the binder. Another great advantage in having some of the land manured in advance was that after wet spells during seed-time they could go on with their broadcast seeding until the land was fit to drill again. Bonedust should be applied as early as possible; but the soluble supers might be carried down too far for the wheat to get the benefit at the start, if heavy rains fall soon after it is applied. After seeding, harrow well with light harrows, taking care to keep them clean, and avoid dragging. All stones and sticks should be cleared off the land, and when the crop is well above ground, and before the land sets, roll to level the ridges left by the harrows. Neglect in this direction meant considerable loss of hay, as the binder must be set to clear these ridges by at least an inch. He had seen hundreds of acres on which 5 in. to 6 in. of the best hay had been left on the field, because of the neglect to secure a level surface. This 4 inches or so over 200 or 300 acres represented a considerable amount of hay. Whenever a farmer has a fair quantity of hay to cut he should use a good binder. The hay is free from dirt and dust, and if well stooked it will stand a lot of wet weather without injury. Besides, the binder cleans the land, and the crop is harvested in less time and labour. Two men and a boy with a waggon and team can cart and stack in the paddock 15 to 20 tons of sheaved hay per day. Care should be taken to have the binder thoroughly overhauled some time before it is needed. A few shillings spent in putting it in good order is money well spent. For market the crop must be cut with a good greencolour in it. The time has gone when grain was considered essential in good hay, and, for export, chaff without colour is looked upon as of little value. He advised stooking almost immediately after the binder, making long, narrow stooks, say one sheaf in the centre and two on each side. Avoid making the sheaves too large. If these two points are attended to, it will not matter how green the hay or how much rain may fall; good wheaten hay will not suffer much in the stook. Hay should be stacked as soon as possible after it is dry enough. It comes out of the stack in much the same condition as it goes in, and if allowed to lay out in the field until parched and dry it will come out of the stack, even in the middle of the winter, in the same state. Such hay cannot be got into a good condition for chaffing, but will split and be dusty, especially if bound in large sheaves. He believed it would pay every farmer to stack his hay promptly in the paddock, instead of carting direct to the chaff mill; the extra weight would pay for the extra labour. The site for the stack should be high and dry, and easy of access. He had seen stacks built in positions from which it would be impossible to remove the hay during the six months of the year. In this district the stack should be set out with the end facing west, so

that the narrow surface only is exposed to the weather. Care should be taken not to build too large a stack; one 20 yards x 7 yards x 21 feet, will hold about 100 tons; the same quantity will go into a stack 17 yards x 8 yards x 21 feet, and he preferred the broader stack, as being easier to build. A good layer of straw or wheat chaff, or preferably sheaved wheaten straw, should be put on the ground, to avoid loss of good hay. He found it easiest, quickest, and best to lay the sheaves with the fork, putting the butts outwards, and laying the second on the strings of the first right through the stack. The two outside rows must not be stacked too tightly. He had seen some men pack, and even knee, the outside rows, while throwing into the middle anyhow. This resulted in the middle settling down more than the outside, and the rain, instead of running off, goes into the stack. If the middle and sides are equally packed, and an extra layer put in the middle occasionally, very little rain will go into the stack, even if a fall occur before it is thatched. In building the stack, take care that it "grows" a little as the sides are raised, so that the water will drop clear when the thatch is put on. Thatching should be done, and done well, as promptly as possible after the stack is finished. He had often seen good stacks of hay, that had cost perhaps £100 or more to grow and harvest, left unthatched, with the result that half is thrown away and useless, and the rest causes much unpleasantness with the chaff merchant. Valuing straw at £1 per ton, the cost of thatching such a stack would not have exceeded £4 to £6. In regard to selling hay, he would advise the farmer to sell a portion of his crop every two or three months. By doing this he would get an average price, and in the long run it would be better for both farmer and merchant. It was a great mistake for farmers to hold on to large stocks late in the season, more especially when hay is dear. Thousands of pounds were lost last year by both farmers and chaff merchants from this cause. Farmers refused £4 per ton at the end of the season, and many sold afterwards at £3 to £3 10s., while some have not yet disposed of their hay. He would always advise them to sell on a rising market, and avoid spoiling their hay by a penny-wise pound-foolish policy. Considerable discussion ensued. Some members favoured round stooks in preference to long ones, as they stand the rough weather better, and if put up properly will resist damage by rain. Some members favoured stacking butts out, except on the roof, where it was preferable to put the heads outwards, as the stack would not then require thatching, if the roof has a good fall.

Importation of Stud Pigs.

By the s.s. "Fifeshire" which arrived from London on the 27th of February, six fine pigs arrived to the order of the New South Wales Government. These pigs, which consist of two Berkshire boars and sows and a Yorkshire boar and sow, were consigned to the Director of Government Asylums (Mr. E. Hanson), and will be stationed at Rookwood and Newington Asylums as soon as the period of quarantine has elapsed.

The Mule.

MR. J. B. THOMPSON, of Ohio, in a lecture on mules for farm work, undertakes to show some of the advantages of the mule over the horse.

To begin with, he says:—"The average period of service of the horse, as given by veterinary authority, is about 10 years, beginning at the age of 3, and although some horses last considerably longer than this, there are quite as many that fail before completing their 13th year. The average period of service of the mule is nearly, or quite, 25 years. He sometimes begins to fail at 20 years old, and in other cases remains as good as ever until nearly 30. Few of his race are worth much after that age. One mule then, in his lifetime, will ordinarily do the work of more than two horses, at an expense each year from 25 per cent. to 30 per cent. less in keeping. Another important consideration is that the mule thrives best on dry feed and grain unground. The reverse suits the horse best, as his feed should be all chopped or ground. His diet should be light and moist, and corn is unquestionably injurious to him, especially when he has to bite it from the cob; but corn is the mule's favourite food, it never appears to have any ill effect upon his system, and nothing is better adapted to his needs than dry hay, if it is good and sweet. This is an item of some consequence when the saving of the miller's toll—never less that one-eighth—and the time and labour of going to mill are all reckoned up; it will make the aggregate difference between the horse's keeping and that of the mule seldom less than 40 per cent. The cost of wintering a mule is computed to be 10 dollars less than that of a horse. This great saving in feed taken in connection with his readiness to labour, his comparative freedom from disease, and the number of years he will work, makes the calculation largely in favour of the mule as a trusty and valuable servant. Not only is the mule much better adapted than the horse to the performance of the labour of the farm, but he does better in drawing heavily loaded waggons on the road, and is especially preferable for the movement of machinery, as his movement is much steadier than that of the horse. The mule is also much less susceptible to disease, and when he does fall ill the trouble is said to yield much more readily to treatment than with the horse. Another and no less important fact is he is much less liable to bone ailments, such as ringbone, spavin, splint, curb, etc., his eyes are unquestionably stronger than the horse's eyes; mules very seldom lose an eye except by accident. In purchasing a mule the buyer will hardly expect to find a blemish, and if he should he will not hesitate to purchase as he would were he buying a horse with the same kind of blemish. Again the mule is convertible into cash at any time from birth to old age, and a dead mule is such a rare thing that the question arises, What becomes of all the old mules?"

Orchard Notes.

W. J. ALLEN.

APRIL.

OWING to the late frosts in the spring in many places, followed by a very dry summer, and with an exceptionally hot spell at Christmas time, the fruit crops in a great many districts were very much below the average, but the good prices which have ruled in consequence of the shortage have in a certain measure made up for the anticipated loss. This has not been the case everywhere, however, as I have visited a few orchards where, owing to the aforesaid causes, the whole crop was destroyed, and except for these fortunate cases this has proved a hard season.

About Wagga Wagga Vineyard most of the grape crop was destroyed by the excessively hot weather which prevailed during the first week of the new year. There were a few varieties, however, which showed no visible ill effect from the heat, although growing side by side with those which suffered so severely. The sultana and raisin grapes suffered about as badly as any, and as a result our output of these dried fruits will be very small this year. The vines growing on the chocolate soil in our Hawkesbury College orchard were only slightly damaged, and I do not think that we lost more than 5 per cent. of the grapes growing on such soils. On the white sand they did not stand the heat so well, and a large percentage was damaged.

The peaches did not attain to so large a size in this orchard as in previous years, but, notwithstanding this, the orchardist (Mr. Alford) has put up some very fine samples of many of the different varieties.

At our Bathurst orchard we have the finest crop of fruit we have ever had, and Elberta peaches planted in 1898 are producing up to six cases per tree, most of which were sold at 10s. per case. The apple-trees are also well laden with fruit, and are bringing splendid prices. The fruit is all graded, wrapped, and nicely packed in layers in the cases, and presents a good appearance when opened up in the auction room previous to being sold. I feel certain that if our apple-growers were to put a little more work into their apple orchards, in place of letting them go practically uncared for, they would have little reason for complaint.

During the past two months I have been over a good many apple orchards throughout the State, and I am sorry to say that it is the exception rather than the rule to find them well cared for, but those who do look after them properly in most instances are well satisfied with the results obtained. Most growers lay the burden of blame on the codlin moth for the state of neglect, and state that until there is an

Act brought into force compelling every grower to use his utmost endeavour to keep this pest in check they cannot hope to keep their trees clean.

In cases where the grower intends to give his orchard two ploughings, the first should be completed at as early a date as possible. Outside of this, the land should have as complete a rest as possible until the winter ploughing, when all weeds which may have grown will be turned under while still green, and before they seed. It is now rather late to sow seed for green crops, as there are very few crops which will make satisfactory growth between now and August, which month in most instances is quite late enough to do the winter ploughing.

Planting of citrus trees may be continued this month. When autumn planting is practised, care should be taken, in handling such trees, not to expose the roots to either wind or sun for any length of time.

Codlin moth bandages must still be kept on the trees, as, even after all the fruit is removed, an occasional grub finds its way to the bandages. All props should be removed from the orchard, and any grubs adhering to them destroyed.

All dormant bud ties may be removed this month. The stones and pits of the different fruits required for stock raising may be planted this month.

Trees required for refills, or for planting new orchards, should be secured as early as possible, and all land which is to be planted should be prepared without delay.

In purchasing trees, deal only with nurserymen who are known to have a good reputation, and who are raising their own trees, as it is to their interest to supply nothing but good stocks, if they hope to do any future business. There is nothing more discouraging than to find, after growing trees for three or four years, that the varieties are worthless.

Growers in different localities often find that they have a variety which is doing exceptionally well in their particular district. In this case, if they are not sure of the name, and cannot get it properly named, I would recommend that they should send their wood to a nurseryman and have him work as many trees for them as they require. In this way they are sure to get exactly what they require, and I feel sure there is not a nurseryman who would not undertake to carry out such a contract carefully.

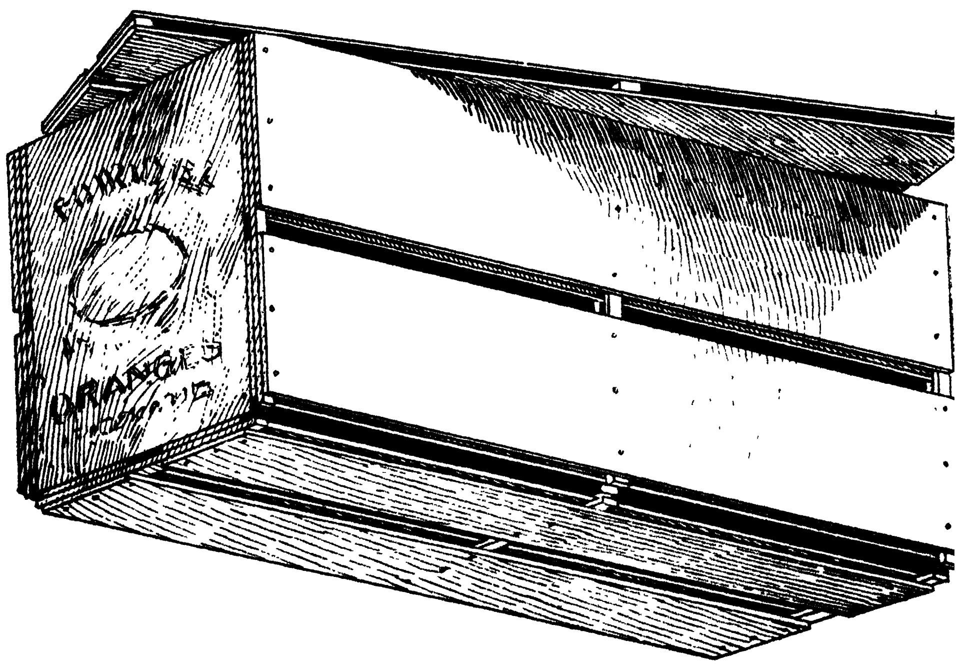
Two or three good varieties are much better than two dozen, and one case of good fruit is generally worth as much as three or four cases of poor fruit; therefore it is well to exercise great care to choose only the best if it is hoped to make fruit-growing pay.

Some few months ago there appeared in both American and Australian papers descriptions of a seedless apple which had been raised in one of the American States, and which it was claimed would resist the

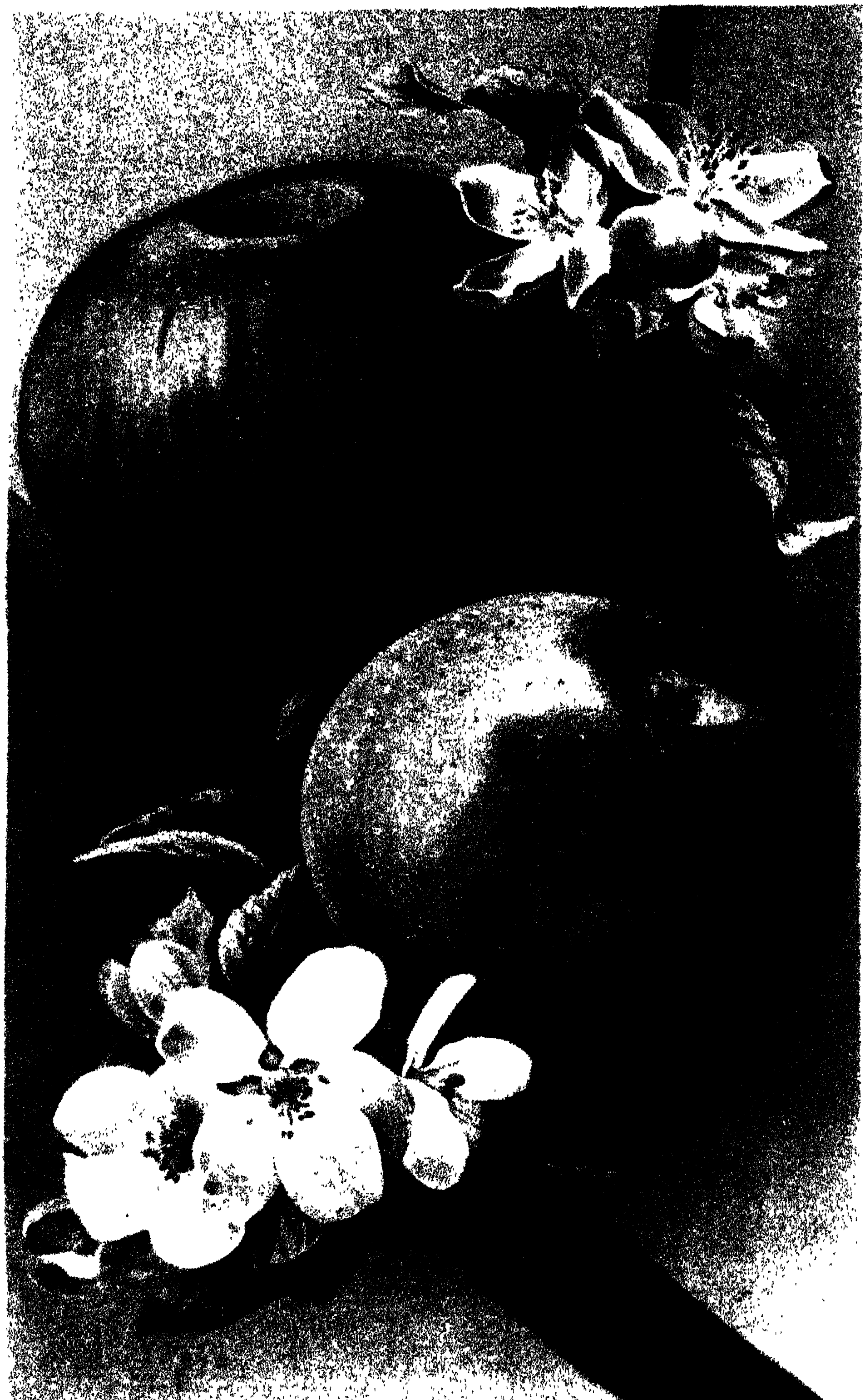
ravages of the codlin moth, owing to the fact of its having no seeds. I may say that among our collection we have a seedless apple in one of the Departmental orchards, but our experience has been that the codlin moth will enter it, and thrive as wellin this as in apples with seeds. I have found fully-developed grubs in the fruit, which does away with the theory that the moth will notbreed in seedless apples.

California Orange Case.

The case, as shown in the accompanying cut, is that used for exporting oranges from California to Australia. If one should happen to be down at the wharf when this fruit is being landed, hundreds,



and sometimes thousands, of such cases may be seen in stacks, filled with citrus fruits from the Golden State. It may be of interest to many of our growers to see the way such cases are made. It will be noticed that it is practically a double case, and the pressure of the cases when stacked one on top of the other does not bruise the fruit, at the same time the extra air-space ensures good ventilation; and I must say tnat most of the oranges land in splendid condition, and find ready sale during our off season.

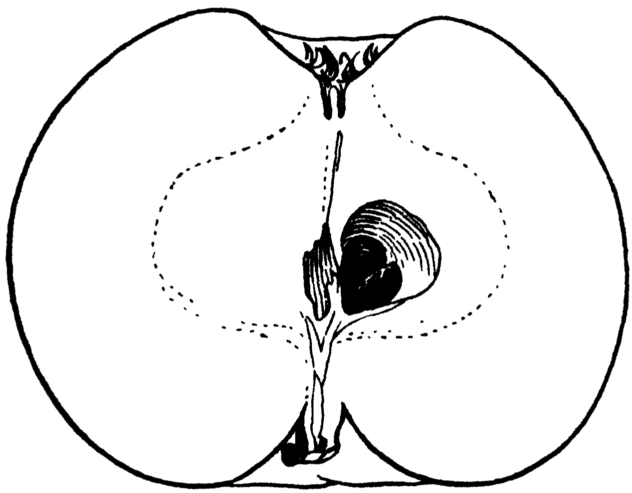


APPLES.

1. MISSOURI PIPPIN 2. ROKEWOOD

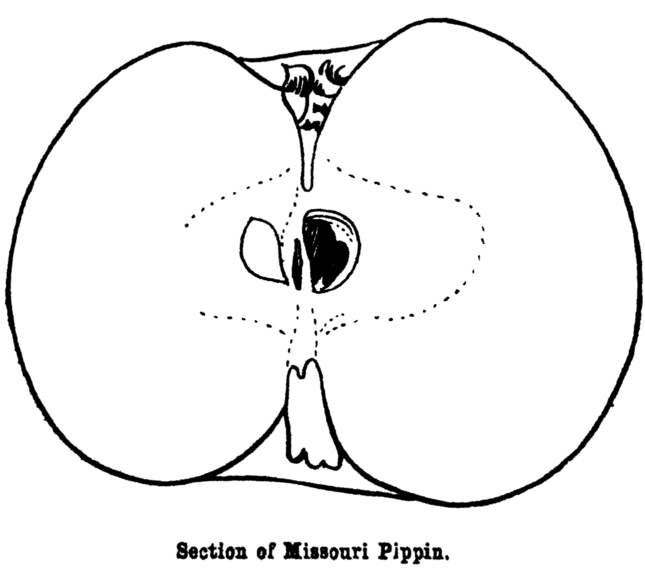
COLOURED PLATES.

Rokewood—Said to have been raised in Victoria, and is sometimes called Bullock's seedling. Tree upright, obliquely spreading. Fruit small to medium, oblate, inclined to conic. Stalk short, inserted in rather a small cavity. Eye almost closed, set in a small, regular basin. Skin greenish yellow, mottled, obscurely striped, and splashed with red and with numerous fine russet dots. Flesh white, firm, and juicy, sub-acid. Heavy crop of medium quality. Ripened at Wagga, middle of May. Good keeper.



Section of Rokewood.

Missouri Pippin.—Fruit medium sized, roundish, oblate, striped with transparent red on greenish-yellow, crisp, breaking, sub-acid, good stalk, short, set in an even small cavity. Calyx closed, set in rather a small, shallow basin. Keeps well. Crops well at our Wagga orchard.



Section of Missouri Pippin.

Crown Lands of New South Wales.

The following areas will be available for selection on and after the dates mentioned :—

H.S. or S.L. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
			For Homestead Selection.					
			a. r. p.		a. r. p.		£ s. d.	1905.
962	Cassilis ..	....	868 0 0	3	252 2 0 to 333 2 0	Muswellbrook, 53 and 54.	7 17 10 to 10 8 6	6 April
963	Dubbo ..	....	....	1	78 1 0	Ponto (within suburban boundaries)	3 8 6	6 „
*964	Windsor ..	....	577 3 0	35	30 2 10 to 67 1 0	Wilberforce, 1½ to 4½; Windsor, 4½ to 8½.	0 8 2 to 1 3 8	6 „
			For Settlement Lease.					
788	Balranald South.	Poon Boon..	....	1	2,389 1 0	Balranald, 18; Public School site, 14.	59 15 0	13 April
786	Condobolin	Burrawang	....	1	2,645 0 0	Condobolin, 11 to 13, Derriwong, 4.	49 12 0	6 „
787	Gunnedah..	....	....	1	6,240 0 0	Tambar Springs (adjoining), Gunnedah, 43.	32 10 0	11 May
784	Tenterfield..	Clifton and Mole River	10,990 0 0	4	2,345 0 0 to 3,100 0 0	Tenterfield, 18 to 24	24 16 8 to 29 7 10	6 April
785	do ..	do	8,640 0 0	3	2,620 0 0 to 3,060 0 0	Tenterfield, 20 to 24	24 11 4 to 27 15 0	6 „
783	Walgett ..	....	....	1	6,107 0 0	Carinda (adjoining); Walgett, 50; Coonamble, 5.	82 14 0	27 „
789	Wyalong ..	Billabong & West Bland Plains.	9,532 0 0	5	1,452 0 0 to 2,448 0 0	Marsden, ½ to 8; Wyalong, 10 to 18.	33 5 6 to 51 0 0	4 May.

* This area will be open for "originals" only.

For Improvement Lease.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
			Eastern Division.					
					a. r. p.		£ s. d.	1905.
582	Carcoar ..	....	....	1	985 0 0	Mount M'Donald, 1½; Woodstock, 15	9 4 8	Sale, 3 Apl.
577	Inverell ..	Goonian ..	....	1	15,000 0 0	Inverell, 60; Bonshaw, 3.	62 10 0	„ 7 „
593	Queanbeyan	....	....	1	3,007 3 0	Gundaroo, 2; Bungendore 15.	8 0 0*	„ 3 „
596	Rylstone ..	....	....	1	655 0 0	Carwell, 20.. ..	4 1 11	„ 3 „
			Central Division.					
713	Hay ..	....	....	1	4,260 0 0	Darlington Point, 13 21; Whitton, 30.	6 3	Sale, 3 Api.
1332	Narrandera	Tubbo ..	....	1	1,134 0 0	Waddi, 4; Darling Point, 8.	42 10 6	„ 8 „

* Inclusive of rent for Crown improvements.

For Conditional Purchase.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		a. r. p.			£ s. d.	1905.
Albury	Walbundrie ..	142 2 0	Sherwyn .. .	Hume ..	2 5 0	4 May.
Armidale ..	....	140 0 0	Everett .. .	Hardinge and Sandon.	1 10 0	
„	....	149 3 0	„ . .	„ ..	1 15 0	4 May.
Bathurst ..	....	300 0 0	Oberon	Westmoreland	1 1 8	18 „
Bellingen .	....	186 0 0	Waverley .. .	Raleigh ..	1 0 0	18 „
Bombala ..	....	*......	Cathcart, &c. .	Wellesley ..	1 0 0	11 „
Braidwood ..	....	230 0 0	Durran Durra .	St. Vincent ..	1 0 0	11 „
Carcoar .. .	....	322 0 0	Grabine .. .	Georgiana ..	0 10 0	6 April.
„ ..	....	40 0 0	„ .. .	„ ..	0 13 4	6 „
„ ..	....	11,710 0 0	„ Glengarry, &c.	„ ..	0 15 0	6 „
Cootamundra ..	....	400 0 0	Cungegong.. ..	Harden and Clarendon.	0 6 8	6 „
Corowa	Ringwood .. .	220 1 0	Gray..	Hume ..	2 15 0	4 May.
Deniliquin .	Gonn	1,912 2 0	Cobwell	Wakool ..	1 0 0	13 April
„ ..	„	1,954 0 0	„ . ..	„ ..	1 5 0	13 „
„ ..	„	962 3 0	„	„ ..	1 7 6	13 „
Forbes	....	300 0 0	Forbes	Ashburnham.	2 0 0	11 May.
Goulburn ..	....	320 0 0	Laggan .. .	Georgiana .	1 0 0	11 „
Gundagai ..	Cotway . ..	480 0 0	Bungongo . ..	Buccleuch ..	1 5 0	11 „
Inverell	Karoola .. .	1,100 0 0	Redbank & Wyndham	Arrawatta .	0 13 4	6 April.
Molong	....	450 0 0	Moura	Ashburnham	1 0 0	27 „
„ & Orange	....	*........	....	Ashburnham, Wellington, & Bathurst	1 0 0	11 May.
Narrabri ..	....	640 0 0	Queerbri	Jamison .	1 15 0	6 April.
Narrandera .	Narrandera .	100 0 0	Beremabere ..	Cooper .	0 15 0	27 „
Parramatta .	....	755 0 0	Holsworthy .	Cumberland..	0 10 0	4 May.
Tenterfield ..	....	3,000 0 0	Clarence . ..	Buller ..	0 13 4	27 April.
Urana	Brookong	340 0 0	Butherawa	Urana .	1 10 0	27 „
„	Goree . ..	988 0 0	Colombo	„ ..	1 10 0	27 „
„ .	Walbundrie .	55 0 0	Hindmarsh . ..	Hume .	3 0 0	18 May.
Wagga Wagga.	Cowabee	550 0 0	Methul	Bourke ..	1 5 0	13 April.
Walgett .. .	....	2,560 0 0	Grandool .. .	Clyde .	1 3 4	4 May.
Warren .. .	....	291 0 0	Narrar . ..	Oxley .	1 10 0	4 „
„	Enaweena .. .	100 0 0	„	„ .	1 7 6	18 „

* The unreserved Crown lands within a reserve pending selection of the Federal Capital Site to be revoked.

Conditional Purchase as Special Area.

Casino Land District, in parish Tomki, county Rous, 243¾ acres, in three blocks: maximum area, 243¾ acres, minimum area, 40 acres; price, £1 10s. and £2 per acre; distant 13 miles from Lismore Available 27th April, 1905.

Condobolin Land District, in parish Condoublin, county Cunningham, 34¾ acres in one block; maximum and minimum areas, 34¾ acres, distant 1 mile from Condobolin; price per acre, £3 10s. Available 4th May, 1905.

Cootamundry Land District, in parishes Cowcumbala and Cootamundry, county Harden, 147½ acres in three blocks; maximum area, 59½ acres; minimum area, 43½ acres; distant 3 miles from Cootamundry; price, £2 15s and £3 10s. per acre. Available 18th May, 1905.

Lismore Land District, in parish Byron, county Rous; 258 acres 20 perches, in thirteen blocks; maximum area, 20 acres 3 roods 10 perches; minimum area, 17 acres 2 roods 20 perches; within the suburban boundaries of the town of Byron Bay; price, £1 10s. to £4 per acre. Available 20th April, 1905.

Lismore Land District, in parish Byron, county Rous, 137 acres, in one block; maximum area, 137 acres, minimum area, 40 acres; distant 3 miles from Byron Bay; price, £3 per acre. Available 4th May, 1905.

Murwillumbah Land District, in parish Kynnumboon, county Rous, 93 acres, in one block; maximum area, 93 acres; minimum area, 40 acres; price, £6 per acre; distant 4½ miles from Murwillumbah Available 11th May, 1905.

Murwillumbah Land District, in parish Cudgen, county Rous; 616¾ acres, in three blocks; maximum area, 211 acres; minimum area, 40 acres; distant 9 to 9¾ miles from Murwillumbah; price, £2 per acre Available 27th April, 1905.

Young Land District, in parish Young, county Monteagle; 144 acres 3 roods 34 perches, in fourteen blocks maximum area, 56 acres 1 rood 33 perches; minimum area, 43 acres 0 roods 12 perches; distant 4 miles from Young; price, £2 10s. per acre. Available 4th May, 1905.

(Signed) EDWARD MACFARLANE,

Under Secretary for Lands

AGRICULTURAL SOCIETIES' SHOWS.

1905.

Society.	Secretary.	Date.
Hunter River A. and H. Association (West Maitland)	C. J. H. King ...	April 4, 5, 6, 7
Quirindi District P., A., and H. Association	Will. Cadell ...	,, 5, 6
Clarence P. and A. Society	Jas. C. Wilcox ...	,, 5, 6
Bathurst A., H., and P. Association	W. G. Thompson	,, 5, 6, 7
Upper Manning A. and H. Association (Wingham)...	W. Dimond ...	,, 6, 7
Lower Clarence Agricultural Society (Maclean) ...	Geo. Davis ...	,, 11, 12
Orange A. and P. Association	W. Tanner ...	,, 12, 13, 14
Upper Hunter P. and A. Association (Muswellbrook) .	Pierce Healy ...	,, 12, 13, 14
Cooma P. and A. Association	C. J. Walmsley ...	,, 12, 13
Richmond River (Casino) A., H., and P. Society ...	E. J. Robinson ...	,, 12, 13
Royal Agricultural Society of New South Wales ...	F. Webster ...	,, 19 to 27
Dungog A. and H. Association	Chas. E. Grant ...	May 3, 4
Moree P. and A. Society	S. L. Cohen ...	,, 10, 11
Hawkesbury District (Richmond) A. Association ...	C. S. Guest ...	,, 11, 12, 13
Walgett P. and A. Association	Thos. Clarke ...	,, 17, 18
Nyngan and District P. and A. Association ...	Richard E. Burns..	,, 17, 18
Molong P. and A. Association	C. J. V. Leatham	,, 24
Hay P. and A. Association (Hay)	G. S. Camden ...	July 27, 28
Riverina P. and A. Society (Jerilderie)	Wm. Elliott ...	,, 25, 26
Murrumbidgee P. and A. Association (Wagga Wagga)	A. F. D. White ...	Aug. 23, 24
Forbes P., A., and H. Association	N. A. Read ...	,, 9, 10
Gunnedah P., A., and H. Association...	J. H. King ...	,, 22, 23, 24
Grenfell P., A., and H. Association	Geo. Cousins ...	,, 24, 25
Albury Annual Show	Walter J. Johnson	Sept. 12, 13, 14
Wyalong District P., A., H., and I. Association ...	S. G. Isaacs ...	,, 5, 6
Northern Agricultural Association (Singleton) ...	C. Poppenhagen ...	,, 13, 14, 15

[4 plates.]

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PENCILLED AND PARTRIDGE WYANDOTTE.

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Agricultural Gazette of New South Wales.

Farmers' Fowls.

[Continued from page 354.]

G. BRADSHAW.

CHAPTER III.

The Wyandotte.

WHEN, in 1898, I gave the title of "The Wyandotte as a Farmers' Fowl," to a monograph on a breed of fowls then less known than now, its appearance in the *Gazette* prompted complaints as to the nomenclature. The disaffected ones were, however, those who were keeping other breeds of fowls, and rushed to the conclusion that terming Wyandottes a farmers' fowl was tantamount to stating that they were the best fowl for the farmer. It need scarcely be said that no such claim was made for that, or any other breed; my simple contention being that the merits of the Wyandottes, just like the merits of some other breeds, were such as to admirably suit the farmer; that class of the community being in possession of everything considered an essential to the successful and profitable breeding of almost every variety of domestic fowl.

The article throughout never ventured the opinion that Wyandottes were the best fowls for any class of breeders, but was rather a history of the origination of the breed in America, and an exhaustive treatise on its utility merits as testified to by numerous experienced American, English, and Australian breeders, all of whom gave this Yankee origination such a character for the all-round qualities as an egg and meat producer, that to deny the Wyandotte being a farmers' fowl would be to stultify all knowledge of what constitutes the requisites of a breed, suited for those whose object in keeping fowls is profit; and just here it may be said that some people keep fowls whose object is other than that of actual money-making, *i.e.*, as a hobby, just as others do an aviary of canaries, as apart from those who keep one for song; or a cote of fancy pigeons which cost many pounds to purchase and feed, and if exhibited will, perhaps, not win more than a few shillings in the year as prize money. In the same way some people keep Wyandottes; they bring them to the highest standard in shape, colour, and condition, the big outlay frequently yielding no compensation other than the satisfaction of having produced an ideal, which in turn will bring honour and glory to the breeder through the medium of prizes. These people, although frequently losing much on

their hobbies, do the industry vast good, and in their absence the Wyandotte and other poultry-yard originations would still be in embryo.

When special articles are written on any breed of fowls, the usual custom is to paint such in colours so attractive that the novice, or would-be beginner, frequently imagines such the best on earth. A lengthened experience, however, with most breeds has shown that, while some have realised far from expectations, others known as the unprofitable sorts have done well, and knowing this I have always been careful, when giving advice, to assert that there is no actual best breed, being well aware of the fact that the profits largely depend on strain, feed, environment, and general management.

Any sort of hens, whether pure, cross-bred, or mongrel, if young and properly cared for, will give a yearly profit of several shillings per head over and above the food bill. At the same time, the best strains of the best laying breeds in existence, through some even minor act of mismanagement, or one of many other causes, may result, and frequently does, in showing a severe loss.

Coming to the Wyandotte. What was written of the breed in the *Gazette* several years ago relative to its merits and prospective popularity, such have, in the extreme sense of the word, been realised. The birds were then in the hands of but a comparatively small number of exhibitors, the patrons being now increased fourfold and more, which can best be confirmed by the numbers then exhibited at the annual shows, and the numbers on exhibition during the past year.

The Royal Agricultural Society's Show will readily be accepted as evidence. In 1899, the show, after my previous monograph appeared, the numbers of this breed exhibited totalled 37, in all the colours. At the same Society's show, in 1904, the numbers had increased to 143, and further than this—excepting a couple of breeders, who have since left the State—the parties who were enamoured with the Wyandottes, and breeders of them in 1898, are patronising them still. This, however, is but a moiety of the evidence in favour of the forward position occupied by Wyandottes amongst the many breeds of fowls. At the above date Wyandottes were only in the hands of a few fanciers, as the following extract from the article referred to will show: "To get an expression of opinion on the merits of the breed from farmers, I determined to communicate with them, but, wonderful to relate, the idea was no sooner entertained than abandoned, from the very fact that to find a farmer in the whole of this colony who bred Wyandottes was an impossibility."

Such a condition of things no longer exists. Any Friday, at the Sydney saleyards of market poultry, Wyandottes, in every stage of growth and adults, are offered in large numbers, these now occupying the place of the mongrels of former times, and although for killing purposes they may not actually fetch much more than mongrels in the same killing condition, still that they are now bred by the poultry and other farmers for market purposes shows that they are more profitable.

Other and important changes have also occurred with the breed in the interim. I refer to the new varieties since originated. Silvers and Golds were the then principal colours, although Whites and a few Buffs had appeared in Sydney at that time.

Mention was made that even Partridge Wyandottes had appeared in England and America, but not in Australia. Blacks, Buff-laced, Violet-laced, Pencilled, and Columbians are all now recognised varieties, the two latter being duplicates in colour of the one-timo popular Dark and Light Brahmas. Another and important change has taken place within the past few vears in relation to the marking, particularly that of the Silvers. What were considered standard markings or ideals of 1897 would be indifferent specimens now, and fail to catch the judge's eye. The difficulty then was to get clear markings, *i.e.*, the centre of the feather pure white, entirely surrounded with black. There was not much trouble in securing such markings on the breast; but invariably the saddle feathers failed in this respect, the centre being mossy, ticked, or peppery, fluff faulty in colour, and indistinct throughout; while the chief failing in the cocks was sooty hackles and saddle. Another frequent failing in otherwise well-marked birds was a white edge or lacing on the black, known as double-lacing, this putting many a good bird out of competition. Fanciers, however, by careful selection and mating, at last attained the desideratum in many specimens, and no sooner was this done than the fashion was changed, the old-time clear but heavy-laced birds being put aside in favour of still clearer ones, the black lacing being now wanted as narrow as can be, provided no break occur, and this thin line to be as lustrous a black as possible, and known as open-lacing. This change of fashion will be best realised by comparing the pair of Silvers, portrayed in the April *Gazette*, with the ones which illustrated the work in 1898. The Silver hen of that date I described as typical, and connoisseurs in poultry illustrations pronounced it the best that had up to that time appeared. The type and markings were really ahead of anything seen in Wyandotte life; however, as already said, the craze is now for narrow markings, and I think the artist has again produced a pair which, for outline, contour, carriage, shape, or type should be accepted for years to come as an illustrated standard of the Wyandotte breed, while for markings both novice and professional breeder can readily accept them as the recognised fashionable colour-peculiarities of the Silver variety. The above then are the changes which have taken place in appearance since the first publication in the *Gazette* of the Wyandotte as a farmer's fowl.

CHAPTER IV.

Origin.

WITHIN the memory of the majority of those who read these articles, quite a number of new breeds, and very many new varieties of fowls have been created. America has been the seat of origin of most of

them, but whether made in America, England, Belgium, or France, and whether of recent or remote ancestry, all except Orpingtons have numerous claimants as the originators; and even this now popular breed, the Wyandotte, although not much more than twenty years since it became recognised as a pure breed, there is much theory as to whom actually laid its foundation, and what breeds formed the first cross; and it must be here recognised that whatever the history of the English Game and Dorkings, the breeds of the present generation are all the result of crosses of the older sort. So far as Wyandottes are concerned, before they received their present name in 1883—which is that of a tribe of American aboriginals—they existed for ten or twelve years previous, but only as a cross; and under a variety of names a great deal of contradictory matter has been published of them.

Perhaps the most authentic history of their origin is that by a well known American poultry journalist, Mr. T. P. M'Grew, and written for the U.S.A. Department of Agriculture, being portion of a report on American breeds of fowls. Mr. McGrew says:—

"The Wyandotte was for years, before it reached its present perfected state, without a name. Its presence was far from attractive, and its average quality was hardly the equal of the common barnyard fowl. So far as the writer remembers, the first Wyandottes were called Sebright Cochins. The result of investigation was convincing that the Sebright Cochin was the product of the union of a Sebright Bantam and a yellow hen, which might have been a Cochin. Such crosses were termed mongrels. While there was little attention paid to them prior to 1870, immediately after that year they began to attract some public notice, and mention was made of them in a few stock papers of New York State. A later investigation has shown that several parties, in the same section of the country, made an effort to produce the Sebright Cochin by crossing the Sebright with the Cochin. This fact is known from letters which passed between those who made the experiment and who interchanged stock, the letters having been presented for publication. The result of the first accidental cross no doubt prompted others to try the experiment. Consequently, the original foundation of what are now called Wyandottes came as an accidental product of an unusual union. The theory of their origin, as accepted by those claiming to be authority, is as follows:—A Mr. John P. Ray, of Hemlock, N.Y., originated a rose-comb fowl by a cross of a Sebright Bantam male and a yellow Chittagong, which he named Sebright Cochins. Others, who became interested (among whom were the Rev. A. S. Baker and Mr. Benson), produced the same kind of fowl. These three gentlemen became so interested with their newly formed fowls that one of them had them illustrated in the agricultural press during 1872. As a result of the publication of such illustrations these fowls were spread over the country into several States, and were advertised in the columns of poultry journals soon after. Thus, by unguided crosses, was the foundation of this wonderful breed begun. Some carefully planned crosses soon followed, and the able breeder began the labour of moulding them into a set type or form, and of clothing them in a

plumage that should be distinctly laced about the edge. To produce the Wyandotte was no inconsiderable task. To bring the solid buff of the original cross into a white centre with black lacing was hardly conceived of in the start, as is proved by the methods employed later. Both Silver-spangled Hamburgs and Dark Brahmas were crossed upon the Sebright Cochin, Silver-spangled Hamburgs and Buff Cochins were bred together, and the best of all these crosses merged into what were called Eurekas; also Excelsiors, Ambrights, American Sebrights, Columbias, &c. While all these many names were applied, as seemed to please the fancy of those working on their advancement, the majority of the fanciers had about concluded to call them American Sebrights, and the managers of the American Poultry Association, at their meeting of 1876, were asked to accept them under this name. Fortunately for the breed, their admission was refused. This spurred their admirers to more extended efforts, and so, when the time of their recognition came (1883) they were a much improved breed. The name Wyandotte was proposed by Mr. Houdlette, Worcester, Mass., in 1883, and accepted as the future name of the fowl. A general dissatisfaction was shown all over the country at this choice as a name, but those who made the decision should be praised now for their fortunate selection. Time has proved it a most appropriate name, and no one could wish to have it changed.

"The original type of the Wyandotte was the Asiatic, and at the time of origin the standard favoured the Cochin type more than any other. If it were possible to establish these individualities of form, or breed characteristics in the minds of all our poultry people, it would result in our having in our poultry as striking a resemblance of form as we have in our horses, sheep, and cattle. As far as the eye can reach, it is possible to distinguish a flock of merino sheep from any other breed; the same is true of cattle and horses. The breed characteristics are no stronger in these animals than they should be in fowls. When the Wyandottes were admitted as a breed to a position among our standard-bred fowls, they had reached a form and colour quite distinctive. The males favoured the Dark Brahma in form and colour, the body colour being quite like a well-splashed Dark Brahma. They had smooth legs of a smoky yellow shade, and the rose comb. The females in form favoured our present Silver-spangled Hamburg hens. In colour and markings they were quite crude. Some had greyish white breasts and backs, while others had breasts of white ticked with a darker colour, and backs mossed with the grey of the Dark Brahma. A better description would be that they resembled half-sized Dark Brahmas of very inferior colour and having Hamburg combs and smooth shanks. In many cases the breast feathers of the male were black, with a white stripe through the centre a little larger than the shaft of the feather. The back colour of the male was mixed black and brown, while in the female it was mossed quite like the marking of a very inferior Dark Brahma. Such was the original Wyandotte of this now much valued breed."

CHAPTER V.

Varieties of Wyandottes.

THERE is a peculiarity about the breeds of poultry which does not appertain to other stock of the farm. I refer to the subject of varieties, nearly every breed of fowls being subdivided into varieties, the type in them all being the same, colour and markings forming them into varieties, nor is this subsectioning a later-day development, seeing that the oldest breed we have—Dorkings, for which we are indebted to the Roman conquest,—was moderately early in its history divided into several varieties, the dark or coloured, the silver-grey, the red, the cuckoo, and the white, and although now very scarce, some authorities believe the latter to be the original breed. However, leaving aside the colour of the original Dorking, several of the above varieties have been known for one hundred years and more; and when fanciers at that time, with so few breeds to cross with were able to produce the several varieties or colours, with the distinct Dorking characteristics, it is not surprising that in these later times, and with so many other breeds to work upon, there should now be a multiplicity of Wyandotte varieties. Silver or Black Laced, as the preceding chapter shows, were the first originations, and before it got well established, several breeders were experimenting with the object of a second variety. Gold or Bay Laced was the colour sought; and Mr. Joseph McKeen, of Omro, Wisconsin, is credited with having produced a variety embodying the Wyandotte shape of bay or clay-coloured feathers with a black lacing, and which has evolved into the now well-known markings. It is said that Rose-comb, Brown Leghorns, Partridge Cochins, and Gold Sebrights were the foundation. There were several other claimants as originators, one well accepted statement being to the effect that Indian Game contributed largely to the ground colour of the feathers. Mr. Ira C. Keller, of Prospect, Ohio, one of the foremost fanciers of the breed contributed the following on this colour:—"In 1880 Mr. McKeen crossed the Winnebago fowl with the Silver Wyandotte to produce the Golden. He crossed and recrossed the offspring with the Silver until there was but one-fourth of the Winnebago blood remaining." So the Golden Wyandotte of to-day has but one-fourth to one-eighth of the Winnebago blood left. The Winnebago fowl was a large black-red bird, somewhat the shape of the Wyandotte, with a rose comb, red lobes, and yellow legs. The plumage of the male was much the same as that of the Partridge Cochin, while the hen resembled the Malay Game hen. Other strains were made by raising the larger Wyandotte as the foundation, crossing with Partridge Cochins, Golden Hamburgs, or Brown Leghorns for the desired end.

This variety began to be popular in America in 1886, and as with the Silvers the breed was not long there until the fanciers improved it in both type and markings, and at the end of three years the English people were actually selling these improved Wyandottes back to the Americans

for show purposes; the desired rich golden bay in the centre of the feathers supplanting the yellow bay or clay colour, distinctive of the American originations. The only point wherein the Gold Wyandottes differ from the Silvers is in colour, both should be of the same size, type, shape, symmetry, and carriage, the White and Golden Bay constituting the varieties. As with the earlier Silver variety, so with the Gold, the black marking round each feather was much heavier than now, the narrow or open lacing being demanded in both colours, hence the illustration of the Silvers with the above substitution can be adopted as a standard for the Golds as well, and when the Golden Bay is seen in perfection with the lustrous black edging, such constitutes one of the most handsome farmers' fowls extant.

Whites.—It is said the first White Wyandottes originated as sports from the Silvers, and that some of them were known as early as 1882. It is not certain that any Whites were actually made by crossing, as were all the other varieties, or whether all our Whites are bred from the original sports. One thing, however, is certain that the most correctly marked Silvers of the present day occasionally throw white specimens, indeed the Whites come with such persistency that it can safely be attributed to reversion or throwback rather than a sport. It was in 1888 or 1889 that the Whites were admitted to the American standard as a breed, but not till the nineties were they produced in numbers, and now they have become in that country the most numerous of any of the Wyandotte variety, and not only this but have actually eclipsed the Plymouth Rock whether as a breed kept for utility purposes, or by the fancy as an exhibition fowl. The following figures are those recorded at the New York Show in January last, and the three previous years, showing the rise and fall in the estimation of Americans of the breeds which claim American origin :—

	1902.	1903.	1904.	1905.
Barred Plymouth Rocks	228	240	205	265
White Plymouth Rocks	105	78	113	126
Buff Plymouth Rocks	81	79	95	98
Silver Wyandottes	34	28	61	36
Gold Wyandottes	23	29	13	27
Buff Wyandottes	56	48	117	45
Black Wyandottes	11	6	16	19
Partridge Wyandottes	28	41	102	77
Silver-pencilled Wyandottes	...	22	38	42
Columbian Wyandottes	..	16	16	31
White Wyandottes	130	174	232	483

Buffs.—This variety of the Wyandotte family has, like the others, several claimants for the honor of their introduction; however, "made in America" will suffice, and what helped them along at their initial stage was the fact that buff fowls were then becoming fashionable, and for a number of years they were exhibited in increasing numbers. Many stories were told of this variety as the producers of enormous quantities of eggs, which statements were difficult to understand, seeing that there was a general acknowledgment that the Buff Cochin

was largely used in the foundation of the breed. Be that as it may, the last year or two they have not prospered, possibly from the fact that the exhibition colour was so very difficult to breed; white feathers and black, both disqualifying points, appearing in a large number of the progeny of the best-mated specimens. Several importations of this colour have been brought to Sydney, and although their patrons speak well of the utility qualities, the numbers do not seem to increase.

Partridge Wyandottes.—This variety first appeared in 1889. The colour is a counterpart of the one-time plentiful Cochin of the same name, and are said to have originated from a Gold Wyandotte cock and Partridge Cochin hen. It is within the past three years that this colour has become most plentiful, and during the past show season the highest prices ever given or received for a Wyandotte in any country was received for a Partridge cockerel of about 8 months old. Quite a number of high-class specimens have reached Sydney, they appear in goodly number at the principal shows, and although reputed to be excellent layers, those tested at the laying competition have comparatively failed as even moderate layers. The breeders of the variety, however, decline to accept the egg output of the two competing pens as representative.

In size, type, &c, the Partridge should be like the other Wyandottes, the colour that of the Partridge Cochin. Although this variety, like the others, originated in America, there is unquestioned evidence that Mr. Joseph Pettipher, of Banbury, England, manufactured some of this variety about the same time as was done in America. Mr. Pettipher made no secrecy of the ingredients, publicly telling poultry men that he laid the foundation with good Cochin hens. Since that time the English and American strains have become a good deal apart in colour, the Americans favouring what is known as a foxiness in the pencilling of the hens, the male birds being also a bricky-red colour, as opposed to the rich golden bay of the English strain.

The first of the American Partridge Wyandottes to reach England were to the order of Mr. John Wharton, Hawes, Yorkshire, President of the Wyandotte Club, in 1896, and were first exhibited at Liverpool Show the same year. The first to reach Sydney were a number brought out by the late Mr. W. Cook, on his visit here four years ago, the later arrivals being principally from the yards of Mr. Wharton. Classes are being now made for this variety in all the Sydney shows, and it is believed their handsome colour, hardiness, and general good qualities will contribute to their becoming as plentiful in the immediate future as any of the other manufactures of the Wyandotte breed. With all the above colours, the two Sebrights, the Buff, and the Partridge Cochin engrafted into types of the Wyandotte and called varieties, it might be supposed that fanciers had a satiety of sorts. Such, however, was not the case. Wyandottes were booming, and another colour was again contemplated—that of the one-time plentiful Dark Brahma, or, as it was once called, Dark-pencilled Brahma. A year or two from the time of contemplation, this, the fifth variety, was an accomplished fact, and

just as with the other sorts they soon reached England, and, as before, the breeders there in two or three years had beaten the Americans in the perfection of pencilling and other markings, and are already sending some of their productions to actually the same State in which they were originated by Messrs. Ezra Cornell and George Brackenbury. The latter gentleman was the first to conceive the idea of the Brahma-coloured Wyandottes, and to produce such mated a dark Brahma hen with a Partridge Wyandotte cock, and in a number of matings and other crossings got the desired colour, and this colour being that of the Dark Brahma in both sexes, the name rightly should have been Dark-pencilled Wyandottes, rather than this, however, they then received the name of Silver-pencilled, by which they are still called. The top-colour of the male is silvery white, hackle and saddle striped with black, breast and under part glossy black. The hen is a clear grey, pencilled with a darker colour. The type and markings which illustrate this article are considered to be the best that have yet appeared, and will also form black and white illustrations of the Partridge variety previously mentioned. The variety has every promise of becoming plentiful. The first of them to reach Sydney were a number of hens from the yards of Mr. E. G. Wycoff, U.S.A., which took part in the Hawkesbury College third laying competition, and at time of writing, eleven months of this contest has expired, the birds occupying at that time about eightieth place. A few others have arrived to the order of private breeders from England, all of which appear to be of darker markings than the American strains.

Buff-laced.—Another of the sub-varieties, and again made in America, is the Buff-laced, a few of which reached England in 1897. They were, as is always the case, the result of crossing several breeds or varieties with the object of securing a desired colour, or combination of such. The first importations were of very indistinct markings. The English breeder, however, soon perfected the colouring, the Rev. J. Cromblehome being one of the first to secure the desired pattern, viz., a buff feather with a white lacing all around, and in the same manner and uniformity as the black edging on the Silvers. The male birds are marked like the Golds, the breast a rich buff with white edge, the hackle and top feathers striped with white, as the Gold are with black. The colour of the hens is a buff throughout, with a white edging round each feather. Strange to say, this variety has made little headway in the country of its origin, and there will not be surprise if they are allowed to die out there, as the American fanciers appear not to want them, but in England they are taking on well, classes being made for them at some of the big shows. The Countess of Craven is a patron and frequent winner of prizes with this variety, including first at the last Birmingham Show. A few years ago Mr. J. E. Pemell, of Randwick, imported from the originators, Mr. W. C. Keillar, of U.S.A., the only trio of this breed that has yet reached Sydney. The variety being then in its initial stage were as typical as the established sorts, while the colour was indifferent to what was even at that time appearing in America. Mr. Pemell was dissatisfied, and made a present of them to a friend in another State.

Blue or Violet Laced.—These are a counterpart to the above. There are but few of them bred in America, but they are fairly plentiful in England, the only specimens seen in Australia being a few sports thrown by Mr. Pemell's importations. The above two varieties are not likely to be taken up by the fanciers here, while other than delicate markings are essential before they can be recommended as a profitable farmers' fowl.

Blacks.—This colour has been in existence a good many years. They have the Wyandotte type in perfection, but so great a difficulty is experienced in breeding the desired yellow legs that the majority of those who took them up have discarded them.

Columbian Wyandottes.—This is the last of the Wyandotte creations, and although most of the others have been a success it is considered that when the Columbian is perfected more varieties will not be wanted. The desired colour in this branch of the family is that of the Light Brahma, and those who recollect the hundreds of pens of the latter breed which appeared in the shows a dozen years ago will at once acknowledge that Wyandottes with the Light Brahma colour cannot be a variety too many. Some forty specimens of them were exhibited at the World's Fair, St. Louis, last year, and it is said they are becoming plentiful throughout many of the American States. In England they have been taken up, and although classes have not yet been made for them, several specimens have secured prizes in the "any other variety" classes. Eighteen months ago a Sydney fancier sent a good sum of money to England for a trio of the breed; the return English mail, however, brought him back his money, with the advice to keep it for a year or two, as the Columbians were not yet good enough to send to Australia. It is said a few of them are at present in Adelaide. There are a few other unrecognised sorts, such as Piles, Cuckoos, &c., but whether as a fanciers' or a farmers' fowl, or both, the established varieties offer selection enough, and the parties who cannot do well by keeping and breeding Wyandottes of any of the above colours need not expect to make a success with any breed of domestic fowls.

(*To be continued.*)

A Warning to Potato Growers.

Rot, Blight, Late Blight, Downy, or Putrefactive Mildew, Murrain (*Phytophthora Infestans*) in New Zealand.

C. T. MUSSON,
Hawkesbury Agricultural College.

Under the above names is known the very worse disease attacking the Potato. It is caused by a fungus parasite as named above. So far, Australia has been free from the trouble, though now that the disease is admitted as being wide spread in New Zealand, there is great danger of its being brought here, and may be making good its footing even as these lines are being written. This particular blight has been the cause of great loss and suffering ever since its first grave outbreaks in Europe, from 1842 to 1850, known commonly as the Irish Potato Blight or the Potato Disease. It is under favourable conditions so rapid in its action, that when once it appears there seems to be no hope of stamping it out, though timely treatment will minimise the loss and check its spread.

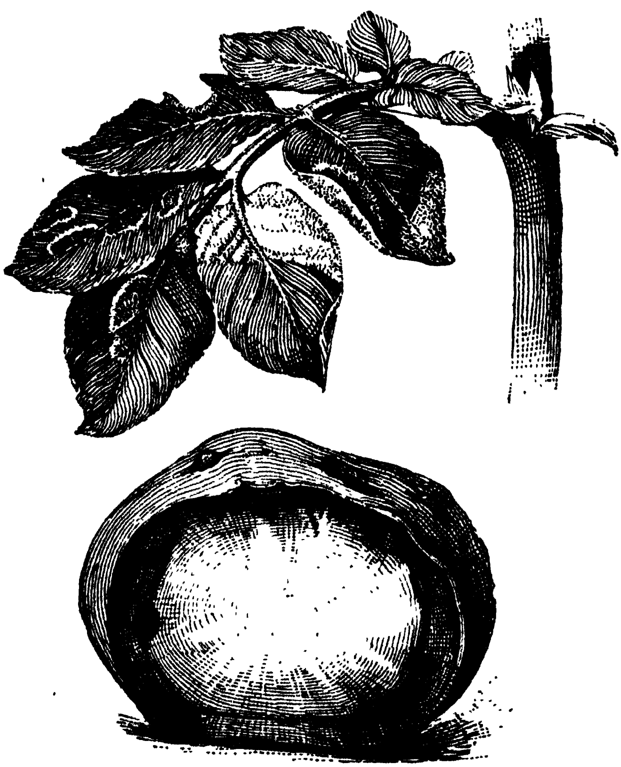
The danger is so near now, that its possible importation into this country should not be lightly thought of, indeed there seems every probability that ere long we shall be included in the long list of sufferers. New Zealand grows about 30,000 acres of potatoes, and exports roughly 15,000 tons annually, probably the great bulk coming to Australia. Reports lately to hand say New Zealand crop is only half the usual quantity *owing to the presence of blight* and the fact that a smaller area was planted. There is every opportunity therefore, for the bringing in, unknown to exporter and importer, the germs of this insidious and devastating pest. We may look for it being brought into New South Wales in tubers sent over in the ordinary course of trade. These might be used in part for planting, though doubtless most of the imports would pass into general food consumption.

Whilst we do not eat rotten potatoes, they are usually not cooked, but thrown with the peelings uncooked into the rubbish bin, and such rubbish is not by any means all destroyed, this potato refuse might be dug into a garden or be carted to a tip. In the former case, if the disease germs were present, they might very well inoculate growing plants, either potatoes or tomatoes, or possibly other members of the solanum family of plants, like the wild black potato.

The chief form of infection: The main way in which growing plants would receive the disease is through the reproductive bodies (spores), blown by the wind, settling on a green plant and at once attacking it. These spores form on the under sides of the leaves. Once a plant is attacked, however, and develops these little bodies

there would be no help for it, the disease would have made good its footing, and would only require time to increase rapidly, and as a result, begin to spread freely, dependent largely on its accommodation to climatic conditions.

These facts cannot be too earnestly impressed upon potato growers in New South Wales, and indeed throughout the Commonwealth. Not having seen the disease here, we are perhaps not alive to the importance of keeping it out altogether, or at least as long as possible.



There is, of course, a possibility that the fungus would not flourish here. It has been stated, with respect to it, as the result of experiments by Jensen, that a shade temperature of over 77° Fahr. for any considerable time is inimical to its welfare. Should such be the case here, we could be pretty sure during at least one of our potato seasons that over certain portions of the State the pest would do but little harm. It can be stated, judging by the fact that related forms found on other plants are admirably suited by our climate, that we should not rely entirely upon our warm climate operating against its spreading to any extent; it is pretty certain that the risk of damage to our potato crops from the introduction of this pest is considerable.

There is no wish on the part of the writer to put forth any alarmist cry with desire to stop potato-growing or cause panic, the object is to warn all whom it may concern, growers especially; forewarned is forearmed; and the menace to the potato-growing industry is really serious, even though the pest may never attain the magnitude it has in other countries. It must not be forgotten, that the trouble might, and probably will, come to us in New South Wales, in a roundabout way, *via* Tasmania, Queensland, or elsewhere, for come it must sooner or later, whether it prove of little importance here as a pest or great. Mr. Maiden reports it as occurring in Norfolk Island.* It is to New

* Proc. Linnean Socy., N.S.W., 1903, vol. xxviii, p. 770.

Zealand, however, we must look as the most likely source of infection. We should undoubtedly take the most rigorous steps to apply the general laws of quarantine to all potatoes reaching our shores from oversea, with respect to this pest.

Growers themselves should do all in their power to secure healthy tubers for planting purposes; it would be well to secure proof as to place of growth, tubers grown in an infected country should be, if not discarded altogether, at least most carefully examined.

Growers should also be constantly on the look-out amongst their crops for any signs of the trouble.

Manner of Life of the Fungus Parasite causing the Disease.

Commonly the early signs of such a disease being present would be overlooked; death of a number of plants or destruction of the crop might occur before the owner had really made up his mind that something was wrong.

Recognition of the first symptoms of the trouble is of some importance; as, in case of attack, early treatment with a suitable fungicide would be likely to minimise the trouble, especially so seeing the rapidity with which the pest acts at times. The first signs of this trouble show themselves as small pale spots on the leaves, they become brown, rapidly enlarge, the leaf substance where attacked turns black and dies. This appearance is especially common near the leaf edges, but may cover the whole leaflet. These early stages somewhat resemble one of the common black spots of the potato plant, but in the latter case the spots remain more or less oval in shape, develop slower, have concentric markings, and do not show the characteristic fruiting stage.

Along the margins of the brown patches of blight, on the underside of the leaf, will be found a fine whitish bloom. This consists of the fruiting organs, which show under a microscope as small lemon-shaped bodies called spores, growing on a regularly branched support, a portion of the fungus body, which grows out of the breathing organs (the stomata) of the leaf for the purpose. These spores are formed in considerable numbers, and, when ripe, are blown away by the wind. They fall to the ground or on other plants, and should circumstances in respect of moisture and temperature be suitable, they burst and discharge eight smaller bodies, in this case called zoospores (animal spores) on account of their being able to move about by means of two fine hair-like attachments (called cilia) with which they are provided, and which act as locomotive organs. It is these last small reproductive bodies which falling on a potato plant, or carried through the soil by water and their own power of movement reach a tuber, which are the chief means of spreading the disease.

When one of these spores germinates, that is, pushes out its growing point, the fungus body thus produced has the power of penetrating any part of the leaf tissue, and also the skin of such tubers as have not tough skins; young tubers and such varieties as have thin tender skins are most liable to attack.

Once the fungus finds entrance into the potato plant it grows rapidly, its fine growing tube-like body penetrates everywhere, and may even run down the stems some distance; it grows at the expense of the whole plant. This body growth or mycelium is enabled to inoculate other potato plants or tubers it comes in contact with.

The usual way in which tubers are attacked is by the washing of the small zoospores through the spaces between the soil particles. The condition of the tuber skin, as already stated, has much to do with its susceptibility to attack or otherwise, consequently it is well, where the disease is prevalent, to take steps to secure varieties with tough skins, as this will largely prevent one source of infection.

Stored tubers can be infected also if a diseased potato is placed with them; the fungus can pass from tuber to tuber, causing a dry rot amongst them. Bruises and cuts are often caused on the skin in the process of harvesting and bagging. This will provide the weak spot, even in a tough skinned potato, where the parasite may find an entrance.

All putrefactive mildews produce a form of "resting" spore attached to the fungus body, and growing within the tissues of the host plant. The potato mildew, however, seems to be somewhat an exception to this rule, as it is doubtful whether in this case these special spores are developed. The special use of such spores, which are commonly formed by various fungi, is to enable them to tide over a regularly recurring detrimental period during which growth or food conditions, or both, are unfavourable; a very important matter to the fungus where seasons are sharply divided into a summer growing period and a cold winter. Here such special "preservative" devices are of minor importance, as throughout our year food and warmth conditions are favourable.

Speaking generally, it may be said of this pest that commonly it gets hold of all weak plants. Here, where plants have frequently to withstand somewhat extreme conditions and may therefore often be weak, the pest might very well become epidemic. This would be most likely to occur during damp seasons or in districts where north-easterly winds are frequent, as on the North Coast. For damp close weather seems to be especially favourable to this and related forms, dry, hot, airy conditions largely preventing their spread.

When it does occur, the rapid destruction of "top" prevents the leaves from forming starch, consequently the tubers cannot form properly. This very rapid destruction of the haulms is due to the fact that the fungus, like others in the group to which it belongs, causes by contact the tissues of the host plant to rot away with an accompanying offensive smell. This specially obnoxious feature makes such fungi doubly detrimental. It is bad enough for the host plant to be robbed of a portion of its own nourishment to the manifest reduction in its growth, but when the host plant dies off rapidly as well, there is no crop at all.

The disease may be present in a mild form for some weeks before any virulent attack comes; consequently there may be a possibility of detecting it in time to use Bordeaux Mixture as a preventive, a plan very successful in preventing great loss.

Recommendations.

Seeing there is no actual cure for this trouble, though by judicious treatment great loss can usually be prevented, and that there is every probability, now it is firmly established in New Zealand, that we are likely to find it amongst us sooner or later, the following recommendations should be carefully noted :—

1. Try and prevent the fungus from establishing itself by—
   (*a*) Taking special precautions as to the origin of "seed tubers." Do not buy without knowing place of origin, and a reasonable guarantee that it was free from the disease.
   (*b*) Plant no tubers that are diseased. It would be a good plan to make a rule to plant no uncut tubers ; the interior is thus exposed, and any "browning" of the flesh should condemn it at once.
   (*c*) Boil or burn all peelings, rotten and waste potatoes.
   (*d*) Go in for saving some potato "apples" (fruits), and by use of the seed try and raise new varieties of potatoes, and thus establish suitable seed tubers without buying from abroad. (See *Agricultural Gazette*, Vol. XIV, part 10, p. 1043, for particulars how to do this in "Evolution of a Potato.")
2. In the ordinary course of cultivation with respect to potato crop, look out for—
   (*a*) First signs of this disease : spots on the leaves, followed by attacked parts turning black, then by rapid rotting of the stem and leaves. All this may occur in forty-eight hours or under.
   (*b*) When the trouble is in the crops, burn all decaying parts where possible and all haulms, or rot them well in a manure heap; they should not lie about.
   (*c*) Bordeaux Mixture applied to the plants at an early stage will prevent the trouble spreading, and is the best means for combating it. Normal strength should be used.
   (*d*) Deep planting minimises the chances of tubers being reached by the zoospores.
   (*e*) Thick-skinned red varieties are less liable to attack than white-skinned.
   (*f*) Nitrogenous manures render plants more susceptible to virulent attack. Potash manures assist them to resist attack.
   (*g*) If it appears, change of ground is absolutely necessary. Tomatoes are liable to attack, therefore should not be planted on affected ground.
   (*h*) Bags, bins, &c., used for storage should be periodically disinfected.

Summarising.

1. We are likely to find this trouble in our potato crops at any time.

2. Use every effort to prevent it getting a foothold. This would appear to be our proper attitude at present, seeing it is not yet, so far as we know, in Australia.

3. When it does come, be ready for it. Be prepared with some decisive steps, based on our knowledge of the method of attack, and particularly as to its means of spreading.

4. Look up in the *Agricultural Gazette* particulars as to other potato diseases likely at first sight to be confounded with this disease, so as to be prepared to decide at once as to the fact, if this one does appear. Timeliness in acting is of great importance. References are given for the purpose.

Wet Rot.—*Agricultural Gazette*, Vol. XVI, 1905, Part 2, p. 186.

Chief symptoms—Wilting, brown ring in flesh of potato near skin; isolated plants or those in a damp place attacked; milky juice squeezes out of eye.

It is quite possible that the milky disease described is caused by a bacillus differing from that of wet rot. A somewhat similar trouble to this has been described, occurring in America, as caused by *B. solanacearum*.

Dry Rot.—*Agricultural Gazette*, Vol. VI, 1895, Part 5, p. 328.

Chief symptoms—Irregular, smoky, brownish patches round the flesh under the skin. This somewhat resembles appearance of tubers attacked by blight.

Black Spot of Leaves.

Numerous small roundish black spots showing concentric rings; slow in developing and not causing putrefaction; not likely to be confused with blight, except at a very early stage.

Murrain.—*Agricultural Gazette*, Vol. II, Part 10, p. 619.

Potatoes Prohibited from New Zealand.

By a proclamation dated March 13th, 1905, potatoes are prohibited from being imported from New Zealand into New South Wales.

Useful Australian Plants.

J. H. MAIDEN,
Government Botanist and Director, Botanic Gardens, Sydney.

No. 93.—*Eremochloa muricata*, HACKEL.

Botanical Name.—*Eremochloa*—*Eremos* (Greek), a desert, *chloë* (Greek), the blade of young corn or grass, and therefore a grass of the arid districts; *muricata* (Latin), full of sharp points or prickles, in allusion to the muricate outer glume.

Botanical description,—genus, *Eremochloa*, Büse.

Perennial Grasses.

Leaves more or less equitant, rigid.

Spikelets 1-fld., flat, secund, solitary, sessile at each internode of a terminal narrow compressed spike, with a rudimentary pedicel.

Glumes, 4, i, nearly flat, oblong, smooth, coriaceous, not awned, margins pectinate; ii, ovate-lanceolate, acuminate, chartaceous, 3-nerved: iii, hyaline, oblong, obtuse, paleate, male; iv, smaller, hyaline, oblong, obtuse, 1-nerved, fem. or bisexual; palea oblong-lanceolate.

Lodicules, obliquely truncate.

Stamens 3, anthers long.

Stigmas, short, feathery.

Species muricata, Hackel in DC's. *Prodomus*, *Monogr. Andropogon.*, p. 262 (1889). Quite glabrous.

Stem, 6–18 in., compressed.

Leaves, 3–6 by ⅛–¼ in., tips rounded, apiculate.

Spike, 2–5 in., linear; rhachis glabrous, brittle, not excavated.

Spikelets, ⅛ in.; gl. i nearly orbicular, dorsally slightly convex, many-nerved, wings crenate; spines very many, upcurved, nearly as long as the gl. is broad.

Pedicelled spikelet, a single lanceolate acuminate coriaceous nerved gl. with thin inflexed margins. (*The Flora of British India*, Hooker, vol. vii, p. 140).

Hackel (op. cit.) says that the Australian form of this grass has narrower leaves often folded longitudinally, spikelets 4·5 to 5mm long, the first glume winged, pectinate, narrower and shorter, differing somewhat from the Indian form, but scarcely worthy of being given a name as a variety.

Hackel separates *Eremochloa*, Büse, from *Ischæmum*, Linn., chiefly by the following characters:—

Ischæmum.—Pedicellate spikelets developed, flower-bearing. Sessile spikelets awned or with the flowering glume at least mucronate-pointed.

Eremochloa.—Pedicellate spikelets very rudimentary. Sessile spikes awnless; first outer glume pectinate-fringed at least at the base. Spike solitary.

Synonyms.—(According to Hackel) *Aegilops muricata*, Retz., *Rottboellia muricata*, Retz., *Ischæmum pectinatum*, Trin., *Andropogon pectin-*

atus, Steud. Recorded previously from the northern coast district of New South Wales (extending to the Table-land) as *Ischæmum pectinatum*, Trin. The grass described in the *Flora Australiensis* as *Rottboellia muricata*, Retz., is, according to Hackel, the var. *commutata* of *Rottboellia ophiuroides*, Benth., and not the true *Rottboellia muricata* of Retzius, which is synonymous with *Eremochloa muricata*. Mr. Betche and I (*Proc. Linn. Soc. N.S.W.*, 1899, p. 151) first formally recorded the genus *Eremochloa* for New South Wales.

Value as a fodder.—A very close-growing grass, forming on even dry stony ridges a close turf (Bailey). It is doubtless a nutritious grass, though specific observations in regard to its fodder value are rare.

Habitat and Range.—It extends from New South Wales to Northern Australia. In our own State it is found on the northern rivers, extending to the Table-land. Found also in Ceylon and in the Indian Peninsula.

EXPLANATION OF PLATE.

A. Part of rhachis with spikelets, back view.
B. The same, side view.
C. Spikelets.
1. Muricate outer glume.
2. Second glume.
3. Third glume with palea and a male flower.
4. Terminal glume with palea and a bisexual flower.
(1–4: Sessile fertile spikelet.)
5. Pedicellate barren rudimentary spikelet, reduced to a short glume.
6. Part of rhachis.

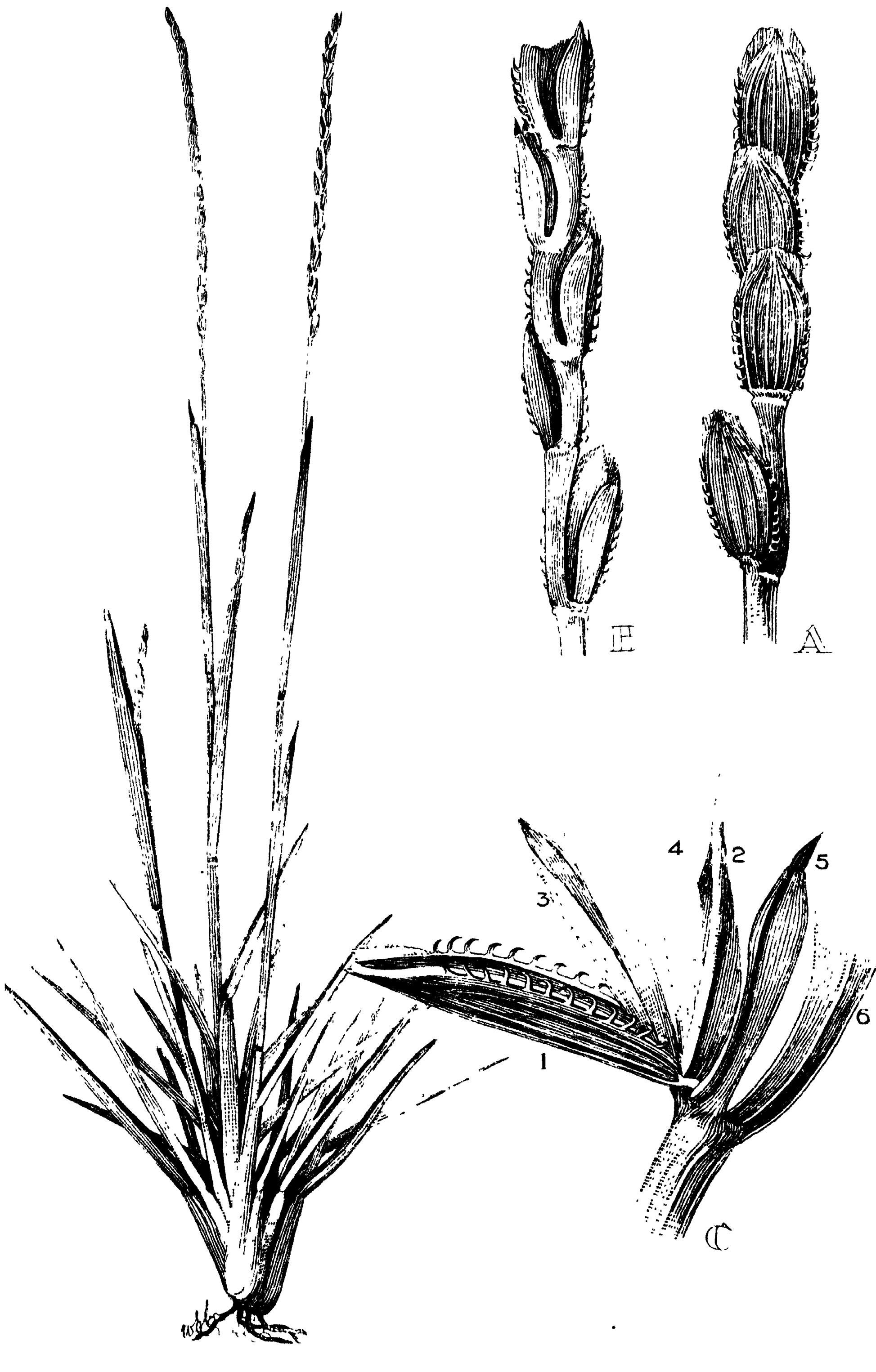
NOTES ON AMSINCKIAS.

BY J. H. MAIDEN.

THESE are weeds with yellow flowers belonging to the Borage or Forget-me-not family. Yellow is an unusual colour for flowers in this family or order. Since the note was written for the *Gazette* for January last, page 27, I have submitted to Dr. B. L. Robinson, of the Gray Herbarium of Harvard University, Amsinckias from several parts of Australia. His reply is that the Blayney plant is *A. echinata*, A. Gray. (This was formerly determined by me as *A. intermedia*.)

As regards specimens from Chiltern, Victoria (H. B. Williamson), and Wagga Wagga Experimental Farm (G. McKeown), which unfortunately do not show the ripe fruit, so important as a diagnostic feature, may, nevertheless, be placed with reasonable certainty in *A. intermedia*, Fisch. and Mey.

So that we have probably two species of *Amsinckia* in New South Wales, viz. :—*A. echinata* and *A. intermedia*. Both are equally noxious, and we shall doubtless hear of them in other localities.



EREMOCHLOA MURICATA, Hackel

The Settler's Guide.

[Continued from page 326.]

Tools.

ROBERT KALESKI,
Bulli Ranges, Liverpool.

Oiling Tools.

Why do we oil tools? For the simple reason, as before stated, that it doubles the life and easy working of them. This being so, what oil is the best to use, and what is the best way to apply it?

Without going chemically into the reason why, which would take too long to explain, it has been found, from centuries of experience, that, like the old carpenter's rule of "wood to wood, iron to iron," in working tools, the rule in oiling is "vegetable oil to vegetable matter, animal oil to animal matter, metal, or stone."

Of the vegetable oils, we have raw and boiled linseed, and castor, from plants; of the animal, neat or bullock's-foot (neat stood for bullock in Anglo-Saxon) oil, and fat or tallow. These are the only ones we need concern ourselves with; the others are no use to us.

The raw linseed oil is pale yellow in colour, and runs easy as water; if dark, yellow, and sticky it has been adulterated with cheap fish oil. The extra refined is very good, and very hard to get; like the boiled linseed, Blundell and Spence's is about the best on the market at present. The boiled oil is naturally much more sticky than the raw, a lot of the moisture having been driven off in the boiling; it is also darker in colour than the raw. The difference in the use of these oils is—that the raw oil penetrates the wood-fibres right through, and only forms a skin outside when these wood-fibres can absorb no more of it. The boiled linseed, on the other hand, is too viscous or thick to enter the wood-fibres, and makes a skin on the outside at once. Thus you can see that if you are oiling or painting wood for yourself (paint is only white or red lead mixed up with oil and colouring matter), use the best raw linseed; and, if doing a cheap job for someone else, use only the boiled; the wood will soon decay as the boiled oil skin wears off, but that is none of your business.

The neatsfoot oil, when absolutely pure, is white; but is never sold so in the shops, being a pale yellow. (You tell it from linseed by the smell.) If you want the real "Mackay" you must square your butcher for it; but good shop oil is all right.

It is unnecessary to describe castor oil; we have all made its acquaintance at some time or other; its only use is to oil machinery, being cheaper than neatsfoot. The best way to handle these oils is to buy a drum of each; then get four sound old drums, fix a small brass tap on each, near the bottom, and put them on a stand about 3 feet

from the ground. You will then be able to use the oil to the last drop without waste; you can get a rebate on the new drums, or keep them for whim or pig buckets.

Now, to apply these oils.—First, the linseed. For oiling handles of any sort, take an empty golden syrup or jam tin, see that it is perfectly clean and dry, and half fill it with your raw linseed; stand your handle or handles in it, and leave them there for a couple of days. Then reverse them in the pot, and, after a couple of days, take them out and give them a rub over with a raw linseed oily rag. They are now fit for use, will spring well, and stand the weather with impunity, if the wood in them is any good at all.

You oil planes differently. For the tryer, jacks, and smoother, you first remove the wedge and iron. Now block the bottom of the opening (or "mouth") of the well, as carpenters call it, securely with putty, and pour raw linseed oil into it till almost full. Leave it for a couple of days, and you will find that the thirsty beech has drunk up all the oil. Fill her up again, and she will soak up about half of that. When you find she will drink no more, pour the rest back into the drum, remove the putty, clean, and she is ready to work. If you want a pretty plane, rub the sides and top well with the oil also; she will then look as if she had been polished. If likely to get rough treatment, give her sides and top a coat of boiled oil over all; this saves planes wonderfully. For other planes, leave them in a billy of oil for a couple of days, first removing the iron (the wedge wants oiling as well). Then rub them on the sides, and they are ready for work. There is a tradition amongst shopkeepers that all tools and handles are well oiled before they leave England. If so, that oil takes care to escape on the way out; gets licked out in the Red Sea, perhaps. Iron planes, of course, you do not oil at all, except the bed or wearing surface. You must keep giving this a dab with raw linseed or, preferably, neatsfoot oil, or you will not be able to work it at all.

To apply neatsfoot: You must keep a little oil-can full of it on the bench; when your oilstone will not bite, or your saws cling, or feel a bit rusty, flirt a few drops on as needed. Grease or fat will answer the same purpose, but is not so good.

Hints on Buying Second-hand Tools.

Having in my youth worked at the bench for twelve months with an old tool-buyer, and learnt the art with him, I mostly buy all my tools second-hand, and save about 60 per cent. thereby, and tools run into money. The following hints from my experience may help others:

(1) In buying second-hand tools, go round the pawnshops and second-hand places devoted to such.

(2) Know what tools you want, their proper brands, and their present price, new, in Sydney.

(3) Look round each shop as you go in; if the articles you want are not readily procurable, do not waste time stopping.

(4) If they are not, and you see a tool you may want, good and cheap, snap it at once; it will be gone when you want it.

(5) Look carefully at each tool for flaws, and reject any that have been patched up, unless you can patch them better with little trouble.

(6) Never, under any circumstances, believe anything the salesman tells you as to the tool's quality: the more emphatic the seller the bigger liar, as a rule.

(7) Do not leave deposits on any tool; buy it right out, or you will most likely have trouble about it later on.

(8) Some salesmen try to bluff a buyer into taking a thing; the minute one starts this game throw down the tool and prepare to leave; this will bring him to reason.

(9) Carry an up-to-date price list in your pocket; its saves argument.

(10) A fair price for good second-hand tools is 35 to 50 per cent. of their new price, according to quality.

(11) All nuts rusted tight, rusty tools, &c., can be fixed up with a little kerosene.

(12) If possible, go round once with a good buyer, and get him to show you how to pick good tools.

(To be continued.)

Vitality of Plants.

W. S. CAMPBELL.

Some little time ago, whilst at the Departmental Cold Stores, Darling Harbour, the officer in charge brought under my notice a small case containing cuttings of grape vines packed in sphagnum moss with fine charcoal mixed through it.

This box of cuttings had, I discovered, been kept by some mistake in the cold-room at a temperature of from 28° to 38° F. for more than fifteen months. I examined the cuttings, and they seemed to me to be quite sound and good, and I took a few to test. The weather was exceedingly hot, and seemed to me a favourable time for a test. I first of all laid the cuttings in a shallow trench, saturated them and the soil with water, and covered them about 3 inches deep with soil. After a week or so I took them up; and they were quite fresh and the wood-buds quite plump and satisfactory. After a necessary trimming I inserted them in a pot of clean sharp sand and kept them well watered, and in a very short time they calloused, and then made good roots. The vines have now grown well, just as well as if fresh cuttings had been used. From one of the cuttings I cut out a wood-bud, inserted it in sand amongst cuttings of various kinds of plants, under a bell-glass. This soon struck root, and is now a good plant.

I think it quite possible that the cuttings would have retained their vitality in the cold store for a very much longer period of time.

Ducks and Duck Farming.

D. S. THOMPSON,
Poultry Expert, Hawkesbury Agricultural College.

I.

DUCKS.

THE domestication of the duck dates back to unwritten history. The wild duck is found in every habitable portion of the globe. It is found in numerous varieties, according to the conditions of climate and surroundings. It is found in the Old World and it is found in the New.

It is to the Old World the credit is due of bringing the wild duck into domestication and making it profitable and useful to the wants of humanity.

In Asia and Europe the first traces are found of the domestication of the duck. The wild duck found in those continents is the Mallard (*Anas boschas*), which is also found in North America, and from this variety the whole of our farm-yard ducks have descended. The wild Mallard is rather a small duck, very small indeed compared with the giant specimens of Aylesbury and Rouen, found in our show pens to-day. The original weight of the Mallard was about 4 lb., compared with the 10 to 12 lb. of the farm-yard giant-bred ducks. So that from domestication and evolution the duck has been very much increased in size and also in the quantities of eggs laid.

The wild duck is monogamous, only lays a few eggs near some lake or river, sits for four weeks, and spends a good deal more of her time in swimming around with her progeny. In domestication she has been bred to lay a very much increased number of eggs, her sitting propensity has been bred out of her, and the drake has been advanced from a monogamist to a polygamist. Some may ask is this an advance, but the advance is in the less number of drakes it is necessary to feed to reproduce a payable quantity of young stock for the market.

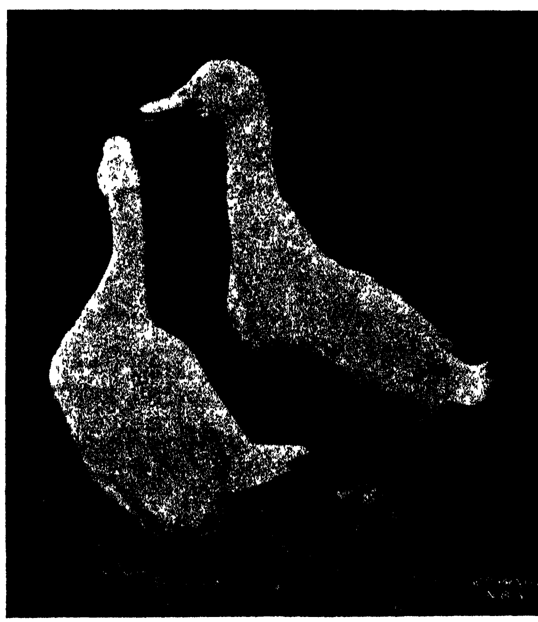
The colour of the Mallard from which our various colours of ducks in domestication have sprung, was a dark coloured duck, very similar to the domesticated Rouen duck of to-day. Wild ducks of the Mallard variety are often caught and kept in confinement for years in various parts of Europe, when they breed freely with themselves and with the various kinds of common farm-yard ducks, and also *inter se*, proving the same unity of species.

When the wild Mallard is bred by themselves, for a number of years in confinement, they gradually show a change of colour, and in some cases white sports and black sports have been found among the progeny after a number of years' breeding, plainly indicating the evolutions of the various colours of our farm-yard ducks.

These articles being written specially for the benefit of distributing information of value to poultry-farmers and other general farmers throughout the State who are constantly in quest of information, it will not be necessary to describe the whole duck world, either in their original wild state or in domestication. The whole of the leading farm-yard breeds of England, America, and Australia will be given, and the reader hearing of any other breed not dealt with can rest assured that it is to-day an inferior variety in comparison with the breeds which are here placed before him. Beginning, then, with the leading breed of the leading country in the world in stock breeding, the Aylesbury duck of England will occupy first position.

The Aylesbury Duck.

The Aylesbury is pure white, without any colour blemish. To have sprung from the dark-coloured Mallard seems extraordinary, seeing the difference there is in colour and size, and also in the number of eggs laid in a season. Here the interesting point of stock-breeding comes in, and in no stock more so than in poultry breeding. The white duck is a sport from the dark-coloured wild Mallard, and the Aylesbury has been so bred in England for generations.



Aylesbury.

The Vale of Aylesbury, in the county of Buckingham, England, gave the name to this pure breed of ducks, and the district has for many generations been considered one of the largest and most important duck-raising districts in England. The London buyer early showed a preference for white ducks, and this gave the Vale a big start over other districts of England, who were not so particular in the colour of the ducks they bred. The pure-bred Aylesbury has now had a lead on the London market for a great number of years, and the consequence is, that this duck has now become the general favourite throughout the British Isles. A good many specimens of this variety have been imported at various times during the last quarter of a century into Australia, but in most cases they have soon been crossed with the Pekin, and *vice versâ,* until it is very difficult to obtain really guaranteed English Aylesbury blood without any mixture of Pekin blood. Not that this lessens the quality, or even value, of them in any

way, because the fact of Pekin and Aylesbury blood being amalgamated invariably gives a hardier duck and a quicker maturer.

The Aylesbury of England pure, and the Pekin of America pure, are both excellent breeds of ducks, and there is little to choose between them. The American will swear by his Pekin every time, while his English rival will equally favour his Aylesbury. On somewhat neutral ground in Australia, it is found, as before stated, that each of the ducks pure are of nearly equal merit, while an amalgamation of both strains in Australia is pronounced to fairly rival both. There is no doubt that most of our Aylesbury stock at present contains a dash of Pekin blood, while most of our Pekin stock contains a dash of Aylesbury blood. In breeding from pure-bred Aylesbury stock imported from England, and pure-bred Pekin stock imported from America, and crossing the two varieties for a number of years, gives a duck which, although containing Aylesbury blood, has the full characteristics of the Pekin.

The Aylesbury, as will be seen from the illustration, is pure white to the skin, with a white bill. The bill is described as flesh-coloured or pinky, but it is more often found simply of a white colour. As will be seen from the illustration, the duck has a long body, which is carried horizontally, the bottom of the neck and tail being about level. The legs are placed about equal distances from the front and tail, which balances the body and gives it its horizontal position. The bill of the Aylesbury is somewhat artificial looking. Nature intended the Aylesbury to have a yellow bill and a yellow tinge in the feather; but the persistent artificial selection of the Aylesbury district breeder, assisted by the soil of his district, and the sandy, gravelly nature of the river bed frequented by them has produced a white duck. Here in Australia the colour of the bill has a natural tendency to revert to the yellow colour, and so even has the skin and under-colour of the feather, particularly so if fed largely on maize.

There is very little distinction between the sexes of the young ducklings, and it is hard to tell the sex until they are able to quack, or the drake assumes his adult plumage, when he grows a curly feather in the tail. Again, as in most other breeds, the drake is generally larger than the duck; but the difference in size is seldom noticeable until you can tell by the other means described. The Aylesbury lays a large egg, about 34 oz. to the dozen—that is, 10 oz. to the dozen over a marketable hen-egg. Compared with the Pekin, there is very little difference in the size of the eggs, some strains of each variety laying larger eggs than other strains of the opposite or of the same variety. Aylesburys are the most popular in England, while Pekins are the most popular in America; and here in Australia the Pekin is the more largely bred.

It is noticeable that, out of nineteen pens competing in the "Australian Hen" Duck Egg-laying Competition, while all other popular breeds are represented—even the Muscovys—there is not a single pen representing the English Aylesbury.

The average weight of Aylesburys is 7 lb. for drakes and 6 lb. for ducks at twelve months old, and this is a fair weight for breeding successfully a large number of market ducks. Many people, and mostly experts in their way, speak of breeding the giant Aylesbury for market; but while the giant Aylesbury of 11 and 12 lb., bred for exhibition purposes, is all right for the purpose for which they are intended to serve, viz., improving the size of worn-out strains, they are not ducks that can be successfully bred for market purposes. Why? Because the duck does not lay nearly so many eggs as her equally well-bred but much smaller sister, nor are the ducks or drakes so prolific; so that the number of infertile eggs is much greater, and the young ducklings do not hatch out so well.

Medium sized stock is the best for market production.

One apparent reason of the Aylesbury being unpopular is, that the colour of the beak is very difficult to keep the proper fleshy pink colour, having a great tendency in our climate to tan with the sun. This makes them unpopular with the exhibitors, and when they get into the hands of the ordinary utility duck farmer, he generally crosses them with Pekins, or by indiscriminate breeding they often themselves throw back to the Pekin, showing that the English Aylesbury breeder is breeding against Nature in the under colour of the feather and the colour of the bill.

The reason of the English Aylesbury breeder breeding for white bill, white under colour, and white skin, is to please epicures supplied through the London market, who prefer white ducks with white skins; but now the Pekin has got on the London market, they are just as readily bought as the Aylesburys are.

The eggs of the Aylesbury vary in colour—some white and some of a light-green tint; but this variation is found in all the domestic ducks, and is not peculiar to any one breed.

The Poultry Club of England's standard of Aylesbury ducks, which is also the adopted standard of the Poultry Club of New South Wales, is appended for reference.

Aylesbury Standard.

General characteristics of drake and duck :—

Head and neck.—Head, long and straight. Bill, long, broad, and strong. Eye, dark and full. Neck, long, medium thickness, slightly curved.

Body.—Breast, full and deep. Keel, very deep, quite straight, and extending from just behind the legs to the breast. Back, long and broad. Wing, strong and carried close to the side.

Tail.—Short, and slightly elevated; plain in the duck, and two or three curl feathers in the drake when in full feather.

Legs and feet.—Very strong and thick in bone, well set so as to evenly balance the body. Toes, straight and webbed.

General shape and carriage.—Large, straight head and bill, well carried on fairly long neck. Body, very massive, with good girth, deep and straight keel, and a full breast, carried low.

Size and weight.—The larger the better. Drake at six months should weigh not less than 10 lb., and a duckling not less than 9 lb. The second year and afterwards the duck should equal the drake in weight, and neither should be under 11 lb.; heavier to count extra merit.

Plumage.—Bright, glossy, and smooth.

Colour in Aylesbury drake or duck :—

Bill, pinky white. Plumage, pure white to the skin. Shanks and feet, bright orange.

Value of points in Aylesbury drake and duck :—

Defects.	Deduct up to	Defects.	Deduct up to
Defects in head and bill ...	15	Want of symmetry	10
,, neck	5	,, size	20
,, breast and keel ...	20	,, condition	15
,, legs and feet ...	5		——
,, plumage and colour	10	Perfect bird to count ..	100

Serious defects, for which a bird should be passed :—

Crooked back ; wry tail ; deformity ; coloured feathers.

Pekins.

The Pekin is the most popular duck in America, just as the Aylesbury finds the most supporters in England. This duck derives its name from the capital city of China—Pekin—where it is to be found to-day. It was imported direct from China to America, and also direct to England from the same source, and importations have since been made from America into England, and *vice versâ*. Here in Australia they have been imported both from England and America, but no account exists of them being imported here direct from China. Whether the English duck is the parent of the Chinese, or the Chinese the parent of the English, or whether they have been crossbred from the Mallard each direct, it would be hard to say; but the last is the most likely—that the Chinese evolved the Pekin from the Mallard, while the English, by somewhat the same process, evolved the Aylesbury. The varieties have each much in common, while they are yet very different in many leading characteristics.

Pekin.

The Pekin is rather a short chubby duck—nearly as broad as it is long. Although the standard describes the body as of medium length, it would be more correct to describe the shape as short and cobby. The legs of the Pekin are set well back, which gives it an erect appearance and makes the bird look more cobby. The legs and beak are of a very dark orange, and form a fine contrast to the colour of the plumage, and which also gives the bird a general healthy

appearance. They are very timid, but that can be said of almost any breed of ducks, although kindly usage often makes them easily tamed and very quiet. The plumage is apparently pure white, but if closely examined, and the feathers ruffled, a distinct yellow under-colour is found. The plumage is very abundant and loose, and very dense on the under parts and thighs. They are very hardy, easily bred, easily reared, and are first-class table birds. As the Aylesbury and Pekin have so much in common, and are so little understood in their varying characteristics, a table of differences of the two birds lucidly pointed out will be of great value to many.

The layman can most easily distinguish the Aylesbury from the Pekin by the colour of the bill, but this is not always to be relied upon. The Pekin should have a yellow bill and the Aylesbury pinky white; but pure Pekins are to be found sometimes with pinky-white bills and Aylesburys with yellow, so this is not always a reliable guide. The next thing, and which is a surer test of the variety, is the colour of the under-feathers; the Aylesbury should be pure white to the skin, while the Pekin must show a yellow under-colour; this is a good reliable test, and, to those who can carry shape in their eye, if they find a long-bodied evenly-balanced duck with pure white under-feathers they can rightly put it down to be Aylesbury, no matter what the colour of the bill may be; on the contrary, a short cobby duck, of great width and carriage erect, head up tail down, and showing a yellow under-feather, can be rightly put down for a Pekin, even with a white bill. The Pekin is rather a quicker maturer than the Aylesbury, but the Aylesburys will eventually outweigh the Pekins, at two or three years of age, the Aylesbury carrying the larger frame. Herewith is the English Poultry Club's standard, also adopted by the Poultry Club of New South Wales :—

Standard for Pekin Duck and Drake.

General characteristics of drake and duck :—

Head and neck.—Head, large, with broad and prominent skull, rising rather abruptly from base of bill.

Bill.—Short, broad, and thick, slightly convex between the juncture of the head and the tip.

Eye.—Dark, and partially shaded by heavy eyebrows.

Neck.—Long and thick, carried well forward and well arched.

Body.—Medium length, and as broad as possible.

Breast.—Wide and prominent, descending evenly, solid and uniform with girth to paunch. No indication of keel.

Paunch.—Broad, and to end of tail forming a perfect half-circle when standing erect.

Back.—Broad, wings short, and carried closely to the side.

Tail.—Well spread and carried high. Plain in the duck, curl feather in the drake.

Legs and feet.—Strong and stout, set far back, causing erect carriage. Toes—Straight, connected by the web.

General shape and carriage.—Almost upright in appearance, elevated in front, sloping downward toward the rear.

Size and weight.—As large as possible, drakes from 8 to 9 lb., ducks 7 to 8 lb. Any excess over these weight to count as extra merit.

Plumage.—Very abundant, with plenty of long soft and downy feathers on the thighs.

Colour in Pekin ducks :—

Both sexes.—Bill, bright orange colour, free from black marks.
Eyes.—Dark leaden blue.
Plumage.—Deep creamy white colouring throughout.
Shanks and toes.—Bright orange colour.

Value of points in Pekin ducks :—

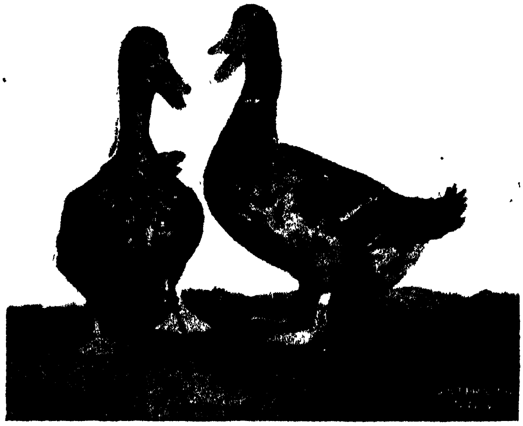
Defects.	Deduct.	Defects.	Deduct.
Defects in head and bill	15	Want of style and symmetry ...	15
,, neck	5	,, size	20
,, body	10	,, condition	10
,, tail	5		——
,, legs and feet	5	A perfect bird to count ...	100
,, plumage	15		

Serious defects, for which a bird should be passed:—

Crooked back; wry tail; deformity; white plumage; black marks or spots on the bill.

Rouen Ducks.

This is the oldest known domestic duck. They have been bred in all European countries, are directly descended from the Mallard, with very little evolution in colour, only very much increased in size by scientific selection. In modern days they are called Rouens, from the town of Rouen, where they were more successfully bred than in most other countries, and many years ago, before being known by any special names, they were imported into England and called Rouen ducks, as coming from the Rouen district of France, as a special duck bred in that district, just as the Aylesbury was specially bred in the Aylesbury district of England. There were many ducks in England similar to the Rouen, but they were not nearly such large specimens as were bred in France. The Rouen is not so extensively bred in England now as they were some years ago, but they have proved very useful, particularly in begetting the Indian Runner of to-day, and the so-called Buff Orpington, both excellent ducks, particularly for laying purposes.



Rouen.

The Rouen is a very large duck, said to be a slow maturer, but as regards the maturing qualities of the three table ducks—namely, Aylesbury, Pekin, and Rouen—undoubtedly the Pekin, being short-framed with less bone, is the quickest maturer; and the Aylesbury and Rouen, while by no means slow maturers, are slower than the Pekin in reaching a given weight in a short space of time, on account

of their extra long bodies, and just from the same cause they grow to a larger size ultimately than the Pekin. The greatest drawback to the popularity of the Rouen is the dark-coloured feathers. Of course, if people can get a better or equally early maturing duck at less or equal cost, and it is white-feathered, they will prefer the white every time.

The Rouen is a handsome duck, and will probably last many years in the show pen, while he is practically forgotten by the utility man.

There is not much necessity to describe the colour, as the description will be found very fully given in the Poultry Club's standard, as follows :—

Standard of the Poultry Club of England, also adopted by the Poultry Club of New South Wales.

Rouen Ducks.

General characteristics of the drake and duck :—

Head and neck.—Head, massive and heavy. Bill, long, wide, and flat, well set on, in a direct line with the eye. Eye : Bold and bright. Neck : Long, gracefully carried in symmetry with the body ; slightly curved, but not arched.

Body.—Body, as wide and long as possible, deep and square in keel, with good bow in front. Breast : Broad and deep. Back : Long and broad. Wings : Large, well covered with flank and side feathers, carried in a line with body, flights resting gracefully on the rump.

Tail.—Three inches in length, only 2 to 2½ inches visible ; composed of stiff feathers, plain in the duck, and two or three curl feathers in the tail in the case of the drake.

Legs and feet.—Strong and massive in bone, medium length, well set, so as to balance the body. Toes : Straight, connected by web.

General shape and carriage.—Great length, broad and square ; deep in keel, just clear of the ground from stem to stern.

Size and weight.—Large and massive ; drakes, 9 to 11 lb. ; ducks, 8 to 10 lb.

Plumage.—Bright and lustrous.

Colour in Rouen drake :—

Head and neck : Rich iridescent green (when in full plumage only). Bill : Bright yellow-green, or green-yellow, with black bean at the tip. Ring : Perfectly white and clean cut, about an inch above the shoulder, dividing green neck and claret breast, not quite encircling the neck, but leaving a small space at the back. Back and rump : Rich greenish black from between the shoulders to the rump. Breast : Rich claret colour, quite free from white lacing or chain armour, coming well below and clean cut, not running into body colour. Flank and sides : A blue French grey ground, very finely but distinctly pencilled with lustrous black, quite free from rust or white. Large coverts : Pale clear grey. Small coverts : French grey, finely pencilled. Pinion coverts : Dark grey. Bar : Composed of a broad purple-blue band, on each side of which is a narrow bar of black, then an outer bar of white, the three colours to be clear and distinct, making a striking and lustrous contrast of colours. Flights : Slaty black with brown tinge, free from white. Stern : Same ground colour as flanks, boldly pencilled close up to the vent, finishing in a curved line, perfectly free from white, followed by rich black feathers up to tail. Tail : Slaty black, with brown tinge. Tail coverts and curl feathers : Glossy green-black. Shanks and feet : Bright brick-red.

Colour in Rouen duck :—

Head : Dark chestnut brown, with a wide brownish-black line from the base of the beak to the neck, two light-brown stripes running from the base of the bill above the eye on either side. Beak : Bright orange ground, with a black bean

at the tip, also with a decided black centre mark on the upper part, which must not extend to the base of the bill, the side edges, or to the bean. Neck : Same colour as the head, with a wide brownish line running from the shoulders up the back of the neck and shading to black at head. Body : Down and under colour, black or dark brown. Ground colour : Rich golden or chestnut brown, even in colour throughout every feather excepting wing-bar and flights; distinctly pencilled from throat and breast to flank and stern with rich black or very dark brown. There should be greenish lustre on the pencilling of the back, wings, and rump. The wing-bars are the same as in the drake. Flight : As in the drake. Tail : Chestnut brown, pencilled with dark greenish brown. Legs and feet : Dull orange brown.

Value of points in Rouen drakes.

Defects.	Deduct up to	Defects.	Deduct up to
Defects in head	5	Defect in colour of tail	5
,, colour of beak	5	,, ,, legs and feet ...	5
,, ,, neck	3	Want of symmetry	10
,, ,, breast	12	,, size	20
,, ,, body	10	,, condition	10
,, ,, back and rump	5		——
,, ,, wings	5	A perfect bird to count	100

Value of points in Rouen ducks.

Defects.	Deduct up to	Defects.	Deduct up to
Defects in head—shape, 3; colour, 3..	6	Defects in legs and feet	5
,, colour of beak	10	Want of symmetry	10
,, ,, neck	4	,, size	18
,, ,, wing	5	,, condition	10
,, ground colour . ..	12		——
,, pencilling	20	A perfect bird to count	100

Serious defects, for which birds should be passed :—

Leaden beak, crooked back, wry tail, deformity, wing twisted, no wing bars, white flights, broken down in stern, no ring on neck, black saddle on beak, white ring on neck of the duck.

In the standard the bill of the duck is described as bright orange ground. Now, who ever saw a Rouen duck with a bright orange ground bill ? The colour of the Pekin bill is bright orange colour, and the colour of the Rouen duck's bill, even with the black centre and the black bean on the tip, cannot be described by anyone as bright orange. Take a Pekin drake or duck with a good orange coloured bill and put it alongside any Rouen that you can find, and see if the ground colour of the Rouen matches the orange colour of the Pekin. While the tip is described as a black bean, the ground colour could be rightly described as the colour of a light brown bean. While there is no necessity to discard breeding from leaden-coloured bill ducks, perhaps it is just as well to discard them in the show pen.

Rouens are being used at the Hawkesbury Agricultural College for evolving fawn-coloured Orpington ducks, and if successful they will be valuable in breeding out with the present so-called Buff Orpington. Again, they have been used very much and very successfully at the College for mule breeding, which will be treated more fully under that heading.

The ducklings of the Rouen are of a brown and yellow colour when hatched, and the colour of both sexes is very much alike in their first feather, until, at about three to four months, the colouring of the sexes begin to change very materially, and the drake when fully clothed makes a splendid blending of colour for an artist's brush. Another point of the standard worthy of being explained is where the description of the head and neck of the drake are given.

Description of the head and neck:—The head and neck is rich, iridescent green; but this you will find is the colour only when the drake is in his full winter plumage, there being about one-half the year when you cannot find a drake answering to the standard described. Rouens are very hardy and easily bred to standard, both in shape, size, and colour, although to get rich-coloured drakes and a good shade of duck, not too light or too dark, a little science in breeding is required.

For breeding rich-coloured drakes, birds dark in colour are required both in the drake and duck, and, to produce a good-coloured duck, use a dark drake and a light duck, but she must be well pencilled.

In treating of the three leading table ducks, all things considered, preference is given to the pure Pekin, and for selling in quantity they have always a good recommendation of preference in feather colour to Rouens, and preference in bill colour to Aylesburys, because a group of strong healthy ducks of white plumage have the appearance of being far healthier than an equal number of Aylesburys with the white bill, the bright orange colour of the Pekin giving a bright healthy tint to the whole flock, and acts as a relief to the eye from the snow-white plumage. Of the three notable varieties the Pekin is more erect and active, and with less frame will excel the other two varieties in egg-production.

(*To be continued.*)

The Prolific "Northern Star" Potato.

We take the following interesting paragraph from the *Farmers' Gazette*, Dublin:—

Messrs. Alex. Dickson and Sons, Ltd., of 55, Royal-avenue, Belfast, have received the following striking letter from Mr. J. Bell, of Parkmount, Banbridge:—"You will be interested to hear the results of two years' growth of the 1 lb. of "Northern Star" potatoes you supplied to me in February, 1903. I cut the pound into 46 sets, and planted them in my garden in May, and dug, in November following, 4 cwt. 2 qrs. 23 lb., averaging nearly 12 lb. per root. From one root, producing nearly 20 lb., I found a tuber weighing 4½ lb. This I cut into 103 sets, and dug its produce this season, 13 cwt. 2 qr. 20 lb., some roots yielding 23 lb. of tubers. I planted the produce of the 1 lb.—4 cwt. 2 qrs. 23 lb.—this season, and now have raised therefrom 50 tons of beautiful potatoes. These results have been obtained entirely from sets; no buds or cuttings were used."

The Work of Bacteria.

Essential Soil Changes Produced by Micro-organisms —Nitrogen from the Atmosphere.

There is a process going on in the soil differing from the latter, which results in a direct loss of nitrogen. This is the phenomenon of denitrification, or nitrate destruction. This process is carried on by the denitrifying organisms, which attack the nitrates already formed in the soil, reducing them to nitrates and free ammonia, the fermentation sometimes going still farther to the liberation of free nitrogen. A writer in *Coleman's Rural World*, in discussing the subject, says that if the soil be abundantly stocked with nitrates, the denitrifying bacteria, under favourable conditions, would be capable of destroying a considerable portion of them. It is claimed by some workers that as high as 75 per cent. of the nitrogen applied to the soil in the form of nitrates is lost by this process. The results of recent investigation, however, tend to prove that this estimate is far too high. Research work upon the oxygen requirements point to the conclusion that the denitrifying organisms develop best when oxygen is excluded. From this conclusion we obtain another clue to the proper handling of the soil and the compost heap. If the soil is allowed to become packed and hardened through lack of cultivation, the air is excluded, and one of the conditions favourable to denitrification is furnished. Again, if the compost heap is packed down, the same result follows. But we have seen how probable loss would ensue by leaving the manure loosely compacted. How shall we avoid a loss? By drawing out the manure as fast as it is made, and spreading it on the land. The loss from leaching is inconsiderable, since much of the organic matter composing the manure is insoluble in water; and little decomposition would ensue, owing to the dry condition the greater part of the time during the summer and the low temperature at other seasons of the year.

Opposed to the process of nitrogen waste through denitrification is another process going on simultaneously with it in the soil: a synthetic rather than an analytic process, whereby simple nitrogen compounds are built up into more complex bodies. This is the process of nitrification, or nitrate building. In most species of plants the nitrogen necessary for their growth must be in the form of nitrates, in order to be dissolved and carried in the sap for ready assimilation by the plant cells. The nitrifying organisms seize upon the ammonia which is formed by the degradation of the complex nitrogenous bodies by the ammonifiers, and by the addition of oxygen to it they form nitric acid, which combines readily with chemical bases in the soil to form nitrates, thus placing the nitrogen at the disposal of the plants.

The nitrifying organisms differ from the preceding classes in their food requirements in that, whereas the denitrifying and ammonifying organisms require at least a trace of organic matter for their best development, the nitrifying organisms do not require organic matter. In fact, they are incapable of growing in the same, although its presence in the soil to a certain extent does not prove fatal to their existence. Hence the advisability of putting too much manure on the land is to be doubted, inasmuch as there would be danger that the reducing bacteria, together with the leaching, would cause the loss of considerable nitrogen before a condition was arrived at under which the nitrifying organisms would be able to thrive.

Bacterial Nodules (natural size) on roots of tares at Hawkesbury Agricultural College Orchard. Reproduced from Agricultural Gazette, January, 1905.

Another point which is just as essential to the rapid development of the nitrifying organisms as a proper food supply is that they should be furnished an abundance of oxygen, as they fail to perform their functions in its absence. Here is further shown the necessity for thorough cultivation in order to afford this supply. This fact would also suggest caution against too frequent fallowing of the land. If it is ploughed, rolled down, and allowed to lie in that condition, nitrification would be diminished by lack of aeration and the reduction its moisture content. On the other hand, experience has shown than fallowing, with frequent and thorough cultivation, often gives beneficial results, due possibly to increased nitrification, with the result that, in the absence of a crop, the nitrates thus formed would be conserved.

When seeds of plants not belonging to the clover family are placed in soil entirely destitute of nitrogen, but containing all the other chemical elements necessary for plant growth, they will start to grow, but as soon as the food material stored up in the seed itself is exhausted, the plants will wither and die. On the other hand, if seeds of the legumes be placed in the same soil, they will also make a start. Then they begin to wither, and undergo a period of "nitrogen hunger," after which they revive and make a vigorous growth. It is only in comparatively recent years that this phenomenon has been understood. If examination is made of the roots of peas, beans, clovers, alfalfa, and other plants belonging to the same family, there will be found on the roots small tubercles or nodules. When cut open and examined under the microscope, these are found to contain myriads of bacteria, which, by experimental investigation, have been proven to possess the property of extracting free nitrogen from the air. Thus it is that the clovers, themselves so rich in nitrogen, enrich the soil by bringing to it so much more nitrogen than they use up.

This phenomenon of extraction of nitrogen from the atmosphere is often successfully made use of in a practical way in reclaiming fields deficient in nitrogen. Fields that are badly run down through successive cropping may be again made to yield by inoculating with soil from a field which has recently borne a good crop of some legume, and sowing a leguminous crop. A good stand may often be secured in this way when other methods fail.

Whether organisms from one legume will produce nodules on other legumes and extract nitrogen from the air is still somewhat of an open question. At first it was thought that each species of legume would grow only one species of nitrogen-gathering organisms. However, the results of recent research indicate that the nodular organisms from any host may produce nodules on any other host, but that they undergo more or less morphologic change in the transfer.

It is supposed that the nitrogen-gathering organisms utilise the free nitrogen of the air only in proportion to the poverty of the soil in available nitrogen. In other words, the plant does not extract the free nitrogen from the air to any extent unless it is forced to do so. Hence it would be unnecessary to use a fertiliser containing nitrates on a field intended for a leguminous crop.

Potash is quite insoluble in water in the form in which it is usually found in the soil. One of the end products of the decay of humus in the soil is carbon dioxide gas, which, dissolved in the soil water, has a certain amount of solvent action upon the insoluble potash salts, producing carbonates, which in turn act upon the silicates in the soil, forming an important class of bodies known as potash zeolites (Chester). In this form the potash is less stable, and although not strictly soluble in water, it is readily so in dilute organic acids, such as result from the decomposition of organic matter.

The formation of sulphates in the soil may also be carried on through the agency of micro-organisms. In the dissolution of proteid matter, hydrogen sulphide gas is set free. The sulphur bacteria in the soil and soil water seize upon the hydrogen sulphide, using it as

a source of energy, oxidising the gas and setting the sulphur free. The same bacteria, as well as others, oxidise the free sulphur to sulphuric acid, which unites in the soil to form sulphates. Hence the cycle is complete, the total result of the action being that the sulphur is reduced to soil sulphates, in which form it may be utilised by the plant.

Iron compounds in the soil are also changed by the activity of micro-organisms, certain bacteria making use of these compounds as sources of energy, just as the last group makes use of the sulphur compounds. The iron is found originally in the soil, and is also formed in the destruction of organic matter, the liberated iron combining with carbon dioxide, which is an active chemical agent, and readily unites with phosphorus or silica which may be in the soil, to form phosphates or silicates of iron.

In discussing the biological changes of the soil, we should consider the relative influence of one process upon another.

When it is remembered that there are about 75,000,000 pounds of atmospheric nitrogen resting upon every acre of land, it is easy to see that the store of nitrogen needed for crop reduction should be drawn from the air through the medium of leguminous plants. The idea that the leguminous plants can draw nitrogen directly from the air is a mistake, as it is the bacteria which lives in the nodules on the roots which give them this power.—*The American Fertilizer.*

By the s.s. "Ventura," which arrived from San Francisco on March the 20th, a small parcel containing nitragin bacteria was received from Dr. Cobb, Pathologist to the Department of Agriculture, by Mr. E. M. Grosse, Assistant Pathologist. This parcel has been handed to the Departmental Chemist, Mr. F. B. Guthrie, who will conduct experiments at the chemical laboratory and elsewhere, inoculating legumes under as wide a range of conditions as the quantity of available bacteria will suffice. A full report of the result will be made when the experiments are completed.

Wheat-growing in New South Wales.

Increasing the Average Yield per Acre.

It is hardly necessary to say anything in introducing this subject. It has been the aim of agriculturists from time immemorial to have two blades of grass grown where but one hitherto flourished. In the case of wheat, if a 5 or 6 bag crop can be obtained in place of a 4 or 5 bag crop, or a 16 bushel in place of an 8, a farmer's lot would indeed be a happy one. It is, no doubt, quite a simple matter to make the most unpromising land bear a crop of wheat in excess of the district average, but will it pay? In all the results published in the reports which follow, this matter, "will it pay?" has not been lost sight of—the fertilizer at Wagga, the fallowing and rotation of crops at Bathurst, the liming at Glen Innes, are within the realms of practical agriculture under conditions of climate, freight, rates of labour, and capital available to the great majority of growers.

There are some good hard facts mentioned in the reports of the managers of the farms that many could profit by, and it is hoped that the practical results obtained at the Experimental Farms will be more generally made use of by farmers, it will be a decided individual gain to a wheat-grower to increase his yield a half to one bag per acre, besides the larger question of the National gain.

Last year New South Wales had 1,584,975 acres under wheat estimated yield 16,121,490 bushels, or a general average 10·2 bushels, an increase of only 1 bushel would mean roughly 1½ million bushels, or £187,500 at 2s. 6d. per bushel.

The average yield for twenty-six out of the thirty-two counties of England visited is, according to Caird, 26¾ bushels, or an increase of 14 per cent. over Young's estimate of eighty years ago; and it is asserted by competent authorities that if the whole of the farms were as carefully cultivated as the best, the yield for the whole of England would be increased by 8 bushels per acre. The same is, no doubt, true of New South Wales. There are instances and not merely ¼-acre isolated lots, but areas quite large enough to be indisputable evidence, where yields of 35 to 40 bushels were obtained last season, while the average for those districts was not more than 16 bushels per acre.

At the Bathurst Experimental Farm, with a very poor rainfall for 1904, yields up to 38 bushels were obtained with a general average for the Farm of 24½ bushels, while the district (being every way as well favoured as the Farm) only averages about 10 bushels per acre This is not due to luck or money, but to a system of rotation adopted (of which fallowing is an important feature) at the Farm by Mr. Peacock, and found by experience to be suitable to the soil, climate, and circumstances.

In the Wagga district crops are not generally heavy, but the light nature of a great deal of the soil makes tillage cheap, and a light crop, compared with Bathurst and Glen Innes districts will yield, perhaps, an equal net return; but even here, the Experimental Farm and others employing similar methods had yields up to 22 bushels for 1904, with a general average for the Farm of 18½ bushels, while the district average is between 9 and 10 bushels.

In studying the reports from the Managers of the Wagga, Bathurst, and Glen Innes Experimental Farms one has only to note the absolute absence of any extraordinary treatment. Timely sowing—selected graded pickled seed—thin, even sowing, on thoroughly prepared ground—suitable fertiliser—rolling and harrowing—and finally, harvesting with a binder—will be found to be the basis of the success achieved. Practically speaking there is nothing new to record in wheat-growing. New varieties more suitable to certain districts, rust-resistant, and better suited for milling, have been raised or brought to notice by Mr. Farrer; but for very many years the general methods of cultivation of wheat have changed but little. There is, however, scope for the exercise of infinite thought in adapting the many methods to the widely varying conditions of soil, local conditions and rainfall. A district may have a good annual rainfall, but not necessarily a well distributed one, for wheat growing; the averages for many years are obtainable and are published in the *Farmers and Fruitgrowers' Guide* in map form. The question of fallowing, in the light of Bathurst experience; the application of lime to sour, recently-cleared ground, as practised at Glen Innes; the use of 3s. worth of superphosphate, as in vogue at Wagga, should be considered most thoroughly by growers.

Wagga Experimental Farm Wheat-growing.

G. M. McKEOWN.

Preparation.

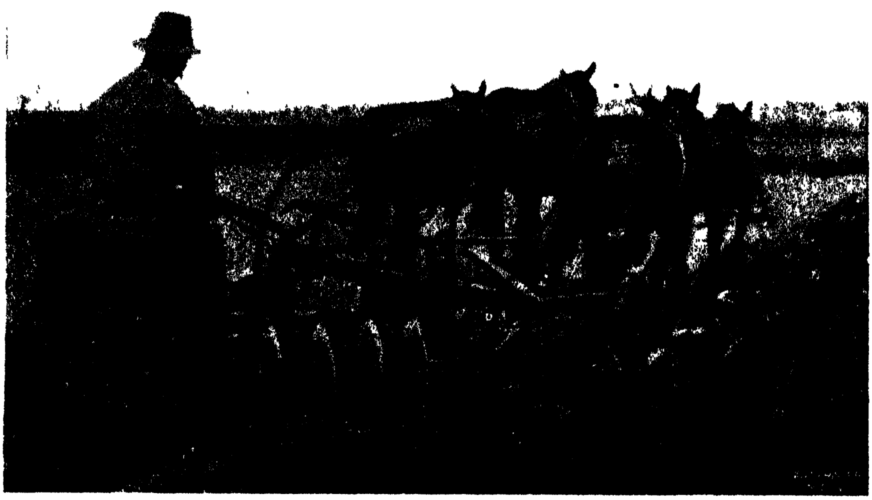
Experience in a variety of seasons has furnished ample proof that it will pay wheat-growers to thoroughly prepare the land for sowing, and it is recommended that all soils of fair depth should be ploughed to a depth of 6 inches where practicable. This cannot be accomplished under all conditions experienced here, as much of the Riverina soil sets very hard in dry weather, and is then difficult to handle.

The use of rotary disc ploughs has largely improved these conditions, as with them it is possible to start ploughing much earlier after the removal of a crop, or when weather conditions are unfavourable. In all seasons we have been able to commence work in January, and in a large proportion of our land it has been possible to perform excellent work in deeply ploughing and pulverising the soil. In addition to their being excellent dry weather implements, their work is very economical, as we have ploughed up to 5 acres in eight hours with

one plough drawn by five horses. The cost of discs is moderate, an expenditure of £3 10s. per year covering the wear and tear under this heading for, say, 500 acres. The cost of repairs is light, one of our ploughs having recently required some new parts for the first time, after nearly six years' use.

The pulverisation of the soil to as great a depth as possible is of very great importance; therefore the value of these implements cannot be overrated. The system of shallow ploughing is to be condemned; and if farmers would prepare areas side by side respectively ploughed deep and shallow, they would soon become convinced that the extra cost of breaking their land 6 inches instead of 3 inches deep the increased crops would amply repay them.

It is sometimes urged that, as wheat is a surface-feeding plant, shallow ploughing is all that is necessary. A forest tree may exist in



Disc Plow at Work, Wagga.

the soil contained in a 6-inch pot, but it cannot attain its full development; and wheat compelled to find nourishment in the upper 3 inches of the soil naturally cannot find as much food and moisture in that space as in 6 or 7 inches of free soil. Besides this, it is often found that when the first 6 inches of the soil is broken, that next below is sufficiently free to readily admit the roots of the plants in search of nourishment at a greater depth.

Rolling and Harrowing.

In soil which is liable to crust on the surface, it is desirable, where rolling is necessary, to carry out the work before the seed is sown, and not to roll afterwards till the crop is fairly well grown, and then to follow with light harrows drawn across the drill furrows. Soils

vary so greatly that it is not desirable to lay down any hard and fast rule on work of this kind, as much can be learnt by observation on the part of cultivators, many of whom have a variety of soils under their care in which uniform treatment would be undesirable. Under our conditions we have usually found it best to leave the land with the slight furrows formed by the drills, as an even surface is very liable to crush and cause the rainfall to run off.

The harrowing of growing crops may be carried out until the crops are about 6 inches high, provided the soil is firm enough to keep the harrows from penetrating deeply, but it should not be done before the plants are well rooted.

Seed Selection.

The importance of seed selection is again impressed upon those who are about to sow; therefore, where individual farmers cannot afford a grader of the best kind, it is suggested that such implements be obtained and worked by groups of grain-growers for their mutual benefit.

Good implements, however, are obtainable at moderate prices; and as considerably increased yields may be obtained by using only the best grade of seed, the cost of a machine would soon be recouped.

Some years ago tests of varying grades of seed sown by hand were carried out on a small scale on this farm, and the results were always in favour of the best qualities. Last season these tests were commenced on a larger scale as field crops, when No. 1 grade seed yielded 2½ bushels more per acre than the second and third grades sown together.

Method of Sowing.

The advantage of drilling over broadcasting seed has been frequently advocated and demonstrated, as will be seen by the accompanying statement of returns. The increased yield, together with the saving in cost of seed, will more than cover the cost of a drill on the first 150 acres. The yields from varying quantities of seed are also shown, and they amply demonstrate the desirability of sowing only moderate quantities of seed, as although sowings of 60 lb. per acre show a larger total return, the average gain from the extra 20 lb. of seed is only at the rate of 4 lb. per acre.

For general field work we set our drills to sow half a bushel; and as grain varies in size according to variety, our average sowing will work out at about 33 lb. per acre. Half a bushel per acre under our conditions we regard as the minimum quantity to be sown.

Treatment for Smut.

As a preventive of smut and bunt, we treat the seed with a 2 per cent. (1 lb. to 5 gallons) solution of sulphate of copper, immersing the seed for not more than five minutes. Should the seed, however, not be well filled, the dipping should accordingly be of less duration. Some varieties are more liable to the attacks of bunt than others, and in such cases it has been found necessary to increase the quantity of

bluestone to 3 per cent. (1 lb. to 3½ gallons). Ten gallons of solution should treat about 10 bushels of seed.

Varieties.

The accompanying statement, showing rainfall and yields during the last six years, will serve without further comment as a guide in the selection of suitable varieties of wheat to sow. As with a number of varieties a number of methods of treatment were used, the best yield is given in each case. It should, however, be noted that the tests were made as field crops, and not in small hand-sown areas. In all cases the blocks extended right across the paddocks used, the distances being respectively 15, 30, and 46 chains, so that a fair average of the soil was obtained, which is not possible where a number of small blocks are laid out across a paddock. The returns are those from manured crops.

Fertilisers.

Tests carried out during the past six years have shown that very profitable results may be obtained from the use of moderate quantities of superphosphate drilled in with the seed.

In districts with a light to fair rainfall a maximum sowing of 60 lb. per acre is recommended, as, if this quantity be exceeded, there is a risk of crops suffering should adverse conditions set in, as a larger bulk of manure may remain partly undissolved round the roots of the plants. In new land the quantity may be reduced to 40 lb. for the first sowing.

The practice of manuring wheat on the lines shown by our tests to be the most successful is now being extensively followed, and no farmer who has once tested the value of the system will abandon it for the old method, under which wheat-growing was far less certain of success.

Our paddocks are rested occasionally by a sowing of rape, which provides pastures for sheep, besides which the rape is of value in opening up the soil for succeeding crops. This practice is also valuable in helping to free the land of weeds, which are also eaten off by the sheep. A partial rest is also afforded by the cultivation of hay crops, which are cut while green, and before the grain reaches a forward stage of development.

Part of the accompanying table shows returns of field crops sown for comparison of manures. The year 1902 has been omitted, as it became necessary to sow another variety of wheat, owing to lack of space, thus breaking the continuity of the tests which I purpose carrying out, if possible, over a period of ten years.

Sowing Time.

The best time for sowing is from the middle of April to the end of May; but, when circumstances require it, a week in June may not be too late. A good deal of sowing is carried out in Riverina before

April; but in our portion of the district crops sown so early, no matter what the variety of wheat, have a tendency to produce too much straw in good seasons.

Should insufficient rain fall in March or April, there is considerable risk of loss of seed, or at the least of a severe check to seed which may have obtained a start.

These risks, however, are greatly decreased by fallowing the land from winter or spring in the preceding year, as land so prepared is in a better condition to receive and retain such moisture as may fall between the ploughing and sowing seasons. As it is seldom that late sown seed returns anything like the crops harvested from seasonably sown areas, it will pay better to fallow such land as cannot be sown by the first week in June.

It has been further noted that a curtailment of the areas sown should place many growers in a position to carry out their harvesting more seasonably, thus benefiting themselves individually, in addition to increasing our district average, as much grain is lost by delayed harvesting.

YIELDS from Manured Crops.

Variety.	1899.	1900.	1901.	1902.	1903	1904.
Rainfall during year	15·90	24·60	17·93	11·97	19·41	16·15
,, 1st Feb. to 30th Nov.	10·87	21·93	17·33	7·57	18·36	13·18
,, 1st May to 15th Nov.	10·12	14·11	13·58	6·54	10·51	11·39
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.
Hudson's Early P. S.	18 49	24 10	24 30	6 26	34 6	16 30
Farmers' Friend	19 24	24 46	27 54	6 31	28 29	20 7
Zealand or Berthoud	14 53	26 4	15 28	3 24	22 11	20 11
Australian Talavera (old)	12 19	26 2	17 58	2 25	26 58	...
,, ,, (new)	..	..	16 46	4 57	28 48	20 57
Steinwedel	15 18	24 7	18 30	6 15	34 30	..
Marshall's No. 3	15 15	28 16	...	...	...	14 9
Dart's Imperial	...	20 25	18 45	4 51	24 55	20 26
Jade	...	30 6	18 46	5 32	30 52	20 24
Lambrigg White Lammas	...	27 49	15 32	4 38	23 37	18 30
Steinlee	.	25 28	14 23	6 6	35 27	..
Nonpareil	...	27 56	18 9	4 55	33 44	...
Jonathan	.	...	18 51	3 40	26 51	16 28
Cumberland		..	19 25	5 43	28 30	18 27
White Essex	...	..	19 30	6 24	32 16	20 20
White Tuscan	.	...	...	5 57	29 10	17 30
Schneider	...	.	...	7 25	32 13	17 4
Sussex	...	...	..	6 17	25 18	17 43
Field Marshal		...	...	6 11	28 14	17 30
Bobs		...	..	5 30	29 23	18 11
Federation	...	.	...	5 20	38 11	22 15
Tardent's Blue		..	13 53	4 2	27 38	17 57
John Brown	..	...	...	...	32 27	17 58
Plover	.	...	...	..	31 21	17 2
Algerian	..	17 35	8 8	3 12	24 58	...
Poland	...	...	7 40	1 19	14 21	...

A number of the above were treated by various methods of manuring, sowing, &c., and the best yield from each is given. Such methods, however, consisted only of deep ploughing, pulverisation of the soil, seasonable sowing with the drill, and the application of fertiliser, the last item in all but 1899 crop costing no more than 3s. per acre.

YIELDS from Varying Quantities of Seed.

	*1900.	1901.	1903.	1904.
Rain during year	24·60	17 93	19·41	16·15
,, 1st February to 30th November	21·93	17·33	18·36	13·18
,, 1st May to 15th November	14·11	13·58	10 51	11·3[illegible]
	Bus. lb. per acre	Bus. lb. per acre.	Bus. lb. per acre.	Bus. lb. per acre.
Variety, Farmers' Friend—				
20 lb. per acre	7 17	21 8	24 14	18 31
40 lb. ,,	14 7	24 54	24 38	20 0
60 lb. ,,	14 52	27 54	23 15	19 12

YIELDS from Varying Quantities of Manure.

	Cost per acre. s. d.	*1900.	1901.	1903.	1904.
None	Nil.	8 57	16 34	16 49	16 45
25 lb. Bonephosphate	1 2	11 56	17 52	15 12	... ..
35 lb. ,,	1 9	13 26	23 4	21 25	18 30
60 lb. ,,	3 0	14 0	23 59	24 3	18 1
60 lb. ,,	3 0	.	. .	26 26	19 12
60 lb. Superphosphate	2 9	.. ..	..	28 29	20 7
None	Nil.	.. ..	.....	13 15	16 45

FROM Drilled Seed against Broadcast (same quantities seed and manure).

	*1900.	1901.	1903.	1904.
Drilled	13 27	25 26	23 15	19 12
Broadcast	11 29	22 22	21 26	16 31

* 1900, sown in July.

Wheat for Hay.

The raising of wheaten hay for home consumption in ordinary seasons, for fodder reserves against drought seasons, or for sale in the city markets, is worthy of greater attention than is usually given to it. Under our conditions a crop of wheaten hay may be counted on with much more certainty than is the case with oats, which requires much more moisture to bring it to perfection. It is, however, possible to secure payable crops of oaten hay when good varieties are sown early in the autumn.

The figures at foot show the crops of wheaten hay harvested at the Experimental Farm during the last five years. The method of preparing the land has been the same as that applied to land used for the production of grain.

The most successful fertiliser has been superphosphate containing a percentage of nitrogen and potash, the quantity used being 70 lb., costing 4s. 6d. per acre. In all cases the seed and manure have been sown with the drill, the quantity of seed used being 45 lb. per acre, first quality grain. March and April will be found the best months for sowing.

White straw wheats are far preferable to the purple straw varieties for haymaking, as the weight is much greater, the straw has far less "dead flag," and the hay is better liked by stock of all kinds. In selecting varieties care should be taken to choose those which carry a green colour to the lowest possible point on the straw. The varieties which have proved the best with us are Zealand or Berthoud, White Essex, Australian Talavera, and White Lammas, in the order named. The best stage of growth for cutting wheat for hay, to secure weight, colour, and quality, is just when it is flowering. If properly saved at this stage and cut into chaff not less than half-an-inch, it will command the best prices in the Sydney market, as the best quality Riverina chaff is much sought after.

The portion of 1903 crop sold in Sydney in September realised up to £4, averaging £3 17s. 10d. for about 80 tons. The yields recorded will show that hay-growing is a profitable branch of wheat-farming if carried out with due attention to all details.

YIELDS OF HAY.

Year.	Area sown.	Crop harvested
1900	154 acres.	523 tons.
1901 .. .	176 ,,	417 ,,
1902 .	200 ,,	36 ,,
1903*	205 ,,	609 ,,
1904 .	200 ,,	227 ,,

* In addition to about 100 tons silage.

Average yield per acre for five years, 1 ton 18 cwt. 3 qrs.
Average annual rainfall, 18·01.
Average rainfall for twenty-five years, 22 inches.

CULTIVATION OF WHEAT AT THE BATHURST FARM.

R. W. PEACOCK.

THE methods employed in the cultivation of wheat at this farm are considerably varied to meet the exigencies of the system of mixed farming practised. The principal aims are the retention of fertility and the production of profitable crops, whether for direct sale, as in the case of wheat, or for indirect sale in the form of products, after having been fed off by, or given to, the stock carried on the farm.

The class of stock mostly catered for is sheep. These allow of such crops as rape, cow-peas, clover, and vetches being grown to advantage, ensuring seasonable operations and remunerative wheat yields under conditions which, by the ordinary practices, would prove disappointing.

The wheat yield for 1904 was an average of 24½ bushels per acre, the highest yield being 38½ bushels. The rainfall for the year was 18¼ inches. A detailed report is appended, a portion of which appeared in the March issue, but will be useful in connection with this subject.

	Variety.	Previous Crop.	Area.	Date sown.	Seed sown per acre.	Date harvested.	Yield per acre.	Rainfall during growth.	Rainfall for year.	No. of Paddock.
			acres.		lb.	1904.	bus. lb.	in.	in.	
Comparable.	*White Hogan ..	Rape .	1	13 April	25	1 Dec.	35 41	10·59	18·26	2
	*Tarragon	,, ...	1	13 ,,	25½	5 ,,	38 43	10·59	18·26	2
	*Australian Talavera	,, ...	1	13 ,,	24½	5 ,,	28 21	10·59	18·26	2
	*White Tuscan .. .	,, .	1	13 ,,	25	2 ,,	33 17	10·59	18·26	2
	*Sussex	,, . .	1	13 ,,	26½	3 ,,	32 27	10·59	18·26	2
	*Cumberland ..	,, . .	1	11 ,,	26	5 ,,	30 45	11·31	18·26	2
	*Plover . .	,, ..	1	11 ,,	26	6 ,,	31 1	11·31	18·26	2
	*Cleveland .	,,	1	11 ,,	24½	6 ,,	26 21	11·31	18·26	2
	*Schneider	,,	1	11 ,,	24	30 Nov.	34 55	11·31	18·26	2
	*Power's Fife ...	,, .	1	9 ,,	25½	13 Dec.	28 57	11·46	18·26	2
	*John Brown .	,,	4·78	8 ,,	25	15 ,,	31 45	11·46	18·26	2
	*Steinwedel	Half Rape and half Field Peas.	8·90	5 ,,	25	9 ,,	32 24	11·31	18·26	2
	*Bobs .	17 acres bare fallow, balance Field Peas.	18·63	28 Mar.	24½	5 ,,	27 48	12·43	18·26	2
	†Hudson's Early P. Straw	Spring Rape	13·27	10 ,,	24	28 Nov.	16 [illegible]4	12·43	18·26	19
	‡ ,, ,, ,,	Wheat	10	12 May	27	14 Dec.	18 6	10·17	18·26	6
	‡Steinwedel	,, ..	8·1	20 April	26	7 ,,	26 21	10·40	18·26	4
	‡Bobs	Canary Grass .	·63	28 May	30	6 ,,	24 2	9·67	18·26	Exp. Plots.
	§Mixed varieties	Wheats	13·59	.		...	19 0	.	..	...

* No manure used. † Eaten off with sheep in June, no manure. ‡ A manure experiment.
§ Cut from headlands, &c.

NOTE.—Total acreage, 87$\frac{1}{10}$ acres, total yield, 2,163 bushels; average per acre, 24 bushels 35 lb.

The first eleven varieties are strictly comparable, the land having been treated similarly in every particular. The Steinwedel is not so, as the preceding crop varied over half of the area it nevertheless was apparently very slightly influenced. Bobs is not comparable to any of the former, it having been sown earlier, and at a time when the weather conditions exercised considerable influence. The whole area also was affected by the disease known as "Take all," which reduced the yield by about 8 bushels per acre. Fully half of the crop died back when about 18 inches high, a second growth taking its place. In order to test the yield of the second growth, a given area was cut off close to the ground on the 14th of September, the second growth being harvested on the 19th December, or 14 days after the main crop; the yield was at the rate of 22½ bushels per acre. This return fully demonstrates the vigour of the second growth, and was exceptional, considering it was cut off so late in the season. The disease is being investigated in order to arrive at some practical

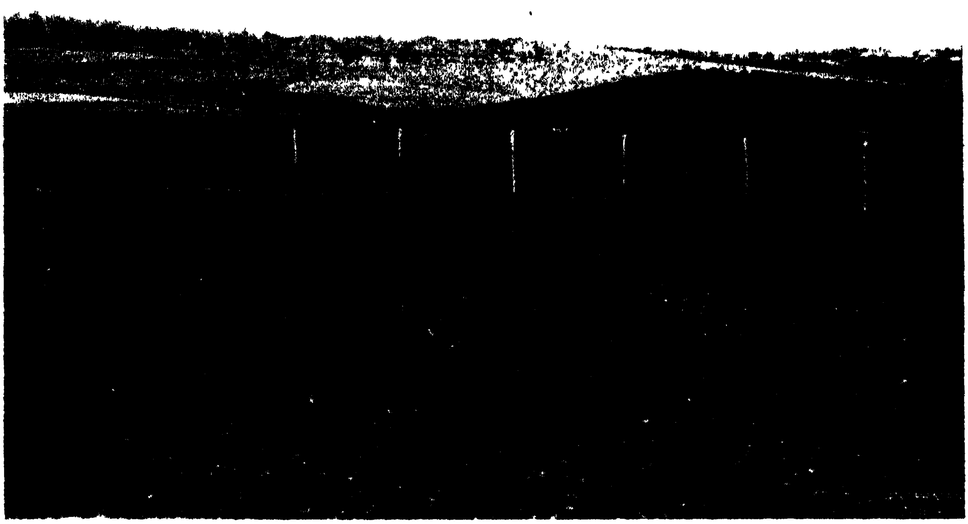
method of combating it. The whole of the area of Bobs had been bare fallowed the previous season.

The other wheats grown are not comparable with each other, nor with the former, as they were grown in different paddocks, subjected to different treatments. Some were grown in conjunction with manure experiments, detailed reports of which will be furnished later.

The mixed varieties represent headlands of various paddocks and areas not otherwise calculated for specific purposes.

In paddock No. 2, which has been worked under a system of rotation, the 40 acres averaged 32 bushels per acre, no fertilizers having ever been used.

The areas on which the manure experiments were carried out had been cropped several years previously with wheat.



A view of the cultivation paddocks, Bathurst Experimental Farm, December, 1904.

The paddock in the foreground is lying fallow; the area to the right is under cowpeas, which are just coming up

The Hudson's Early Purple Straw, in paddock No. 19, gave the lowest yield; the germination was somewhat faulty, and the season proved rather dry to obtain the best results from feeding off with sheep. It is in no way comparable with the others.

These results are attributable to the system of crop rotation followed and the conservation of moisture by the following methods:—

In seasons of limited rainfall the conservation of moisture is of considerable importance, and no matter how rich in plant-food a soil may be, unless containing moisture to allow the crop to assimilate it, the land cannot yield satisfactorily.

Upon all areas cropped continuously with wheat the land is stirred as soon as possible after harvest with multiple ploughs to the depth

of about 3 to 3½ inches. This allows of all fallen grain germinating, which growth is kept down by sheep; it also facilitates the retention of any storms, and conserves the residue of moisture after producing the previous crop. The land generally lies after this ploughing for three months, and is found generally to be readily ploughable, and to contain sufficient moisture, together with any seasonable showers, to ensure the germination of the seed early in April. The land which had been cropped with rape is usually ploughed during November, the residue of the rape crop and the excreta of the sheep being ploughed under. This residue, during the summer months, decays sufficiently to be in a great measure available to the wheat crop in its early stages, thus ensuring early healthy development. The loose condition of the soil absorbs the storms, weeds are kept down by stock, and the land weathers into a mellow condition, which is of considerable importance.

Paddocks which are out of heart and not yielding satisfactorily are bare fallowed, the land being ploughed when the teams are available; weeds are kept down by the sheep, otherwise they would pump out the moisture, which cannot be too jealously guarded. The soil remaining moist, allows of a greater proportion of plant-food being liberated from it and assimilated from the atmosphere, the general result being a measure of renovated fertility with profitable yields. The ploughing of all areas prior to sowing is done thoroughly to a depth of 6 inches, and the seed is sown upon a freshly-worked seed-bed. The seed is sown with a drill about 2 inches deep at the rate of about 25 lb. per acre; 30 lb. are used for later sowings.

The early wheats are sown the latter part of March, the poorest paddocks being sown first. As many of the crops as possible are sown during April, it being considered the best month.

I attach considerable importance to early sowing, as the early growth of the crop prevents the heavy winter rains beating the surface together, thus destroying the desirable texture of the soil, which is conserved and improved by the leaves and roots of the crop.

All the seed used is graded, all shrivelled and cracked grains being removed.

For the prevention of bunt bluestone has been largely used; this was found to interfere considerably with germination in a comparatively dry seed-bed.

Solutions of formalin were also tested, that used at the strength of 1 lb. of formalin to 400 lb. of water, the grain being immersed for five minutes, allowed of an average of 71 per cent. of plants to mature, ranging from 68 per cent. to 75 per cent.; in only one instance were bunty plants found by using this solution of the above strength. In one instance a solution of 1 lb. of formalin to 300 lb. of water was used, allowing of 76 per cent. of plants to mature which were bunt free. Formalin was found to be preferable under unfavourable conditions, and could be recommended as a substitute for bluestone. It was also proved that the formalin solution did not deteriorate when left in an open vessel for one week. Formalin can be purchased at

2s. 6d. per lb., and as 1 lb. will make 40 gallons of solution, it possesses the advantage of being cheap. It is poisonous and a powerful disinfectant.

Manures are sometimes applied at the rate of 1 cwt. per acre. Phosphatic manures have proved the most suitable, superphosphate allowing of the crop to mature fully seven days earlier than the unmanured. Experiments tend to show that nitrogen should be added to the phosphoric acid in subsequent applications. They are not generally applied, by far the largest portion of the wheat crop being unmanured.

When the crop is 4 or 5 inches high it is rolled to consolidate the soil where necessary, and to break clods to facilitate the use of machinery; in no instance is the surface left rolled throughout the summer, but is harrowed before the crop gets too high. The rolled surface allows of the moisture coming to the surface, from which it is evaporated by the sun; it also more readily crusts, which seals the soil pores, this being extremely undesirable. The harrowing forms a soil mulch and increases the desirable tilth. The harvesting is performed with a string binder.

Of the varieties generally grown, Steinwedel has proved the most suitable of the common varieties. Although possessing many faults, it withstands a considerable amount of dry weather, and is prolific.

Of the new crossbreds, Bobs has adapted itself to the conditions, and can be strongly recommended for similar conditions. There are several others which are promising.

The strong flour varieties from Manitoba do not thrive when the summers are dry, the hot winds seriously affecting them before they ripen.

Cultivation of Wheat at Glen Innes Experimental Farm.

R. H. GENNYS.

The experience gained at the Glen Innes Experimental Farm, which lies at an elevation of over 3,000 feet, may be of considerable use to other wheat-growers in the district. The choice of varieties, the system of liming the land to render it sweet, as a more speedy method than any other, is commended to those having similar land in this district, the cost not being great, and the results, as the following tables show, are quite satisfactory—yields such as 28 to 34 bushels being recorded, on the very meagre (for this district) rainfall of 14·5 during growth. To enable growers to see at a glance the behaviour of many well known varieties and some new ones, the results of last season's operations are shown in tabulated form, as being more readily seen and digested—the remarks are particularly worthy of notice. From these it may be seen that some varieties of wheat are absolutely unsuited to this district, and should be carefully discarded.

WHEAT-GROWING at Glen Innes Experimental Farm, 1904.

	Area.	Date sown.	Seed per Acre	Date of coming into Head.	Date of Harvesting.	Yield per Acre.	Rainfall during Growth.	Number of Paddock.	General Remarks.
	re		bus.				in.		
Tarragon	½	8 June .	1½	11 Nov...	29 Dec...	27·1	14·5	1	No signs of smut; slight rust on leaves; grown near green mbe position.
Sussex ..	½	8 „	1½	2 „	28 „	34·26	14·5	1	Slight rust on leaves: fine heads; did well.
Tardent's Blue ..	½	8 „	1½	16 „ ..	2 Jan.	30·5	14·5	1	Rust on leaves and straw; large heads.
Nonpariel .	½	8 „	1½	14 „	29 Dec ..	29·78	14·5	1	Slight rust on leaves; bright clean straw.
Federation . .	¾	9 „	1½	1 „	28 „ .	28 57	14 5	1	Rust on leaves and straw; holds grain well; very short straw.
Schneider .	½	9 „	1½	11 „	27 „	28·10	14·5	1	Slight rust.
Zealand or Berthond	½	9 „	1½	14 „	28 „	29·2	14·5	1	Rust on leaves and straw; very large heads; weak straw.
Plover . .	½	9 „	1½	11 „ .	27 „	28·06	14·5	1	Slight rust; good heads; good straw.
White Hogan . .	½	9 „	1½	15 „	2 Jan.	21·83	14 5	1	Slight rust: long weak straw.
Cumberland ..	½	9 „	1½	1 „	27 Dec...	26·1	14·5	1	Rust on leaves and straw: good heads.
Cleveland .	½	9 „ .	1½	16 „	30 „	12·72	14·5	1	Slight rust; too late for here; did not fill well.
Nutcut .	¼	9 „ .	1½	6 „ .	27 „ .	28·06	14 5	1	Almost free of rust.
Field Marshal .	¼	9 „	1½	8 „	27 „ ..	24·06	14·5	1	Nearly free of rust and smut.
Hybride du Trésir		„ .	1½	18 „	2 Jan.	13·	14 5	1	Very rusty; grain affected by rust; good stooler; too late for h
Lambrigg White Lammas		„	1½	23 Oct	2 „	28·	14 5	1	Slight rust; fine grain; weak straw.
Bobs		„	1¼	4 Nov...	27 Dec. .	26·81	14 5	1	Very slight rust; good straw; good heads.
Power's Fife (1) .		„ ..	1½	24 „	2 Jan.	20·06	14·5	1	Very slight rust, indeed few heads smut: nice straw; did not fi
Jonathan . ..		July ..	1½	15 „	30 Dec...	14·03	12·5	2	Very slight rust; holds grain best of all.
Power's Fife (2)		„	1½	26 „	2 Jan.	15·64	12 5	1 & 2	Very slight rust; nice straw: did not fill well.
John Brown ...		June.	1½	10 „	28 Dec...	26·12	14·5	1	Almost free of rust: good grain and straw.

None of the grain was injured in any way by *rust* except the French wheat "Hybride du Trésir," which was badly affected, and grain a good deal pinched.

Power's Fife could scarcely be said to be affected with rust, as it was only on the outside of crop and on the flag.

The above wheats were all sown broadcast and by hand.

The wheats were treated with bluestone solution, the proportions being 1 lb. of bluestone to 8 gallons of water. Grain allowed to remain in solution seven to eight minutes—hung up in a draughty place, and sown about an hour afterwards.

Manure used was agricultural lime only. In No. 1 Paddock ½ ton to the acre was used, and in No. 2 Paddock 8 cwt. to the acre. Lime was put on at the beginning of May. First put out in heaps of equal quantities the same number to the square chain, and afterwards distributed by shovels to cover all the ground evenly, then harrowed in as soon as possible, so as to mix it with the soil, then left till thoroughly slacked before ploughing in, prior to sowing crop. It might be mentioned ground should be ploughed, also harrowed to fill up holes before spreading. Lime should be kept near the top for a time, as it has a tendency to work downwards. As it was getting late here, paddocks were left after liming about one month, but if convenient I think two or three months would be better still. Wherever there are stiff heavy clay soils lime will be found of much benefit, if only to improve their texture, and it certainly sweetens sour ground previously carrying green timber, after which cultivation here immediately followed; also swampy land after being drained. Unslacked lime should be purchased. It may be slacked by water before putting on land, but air-slacking is the best, and a few showers in any case will make it quite safe for seeds. As much as 1 ton to the acre can be used beneficially in very heavy soils.

Paddock No. 2.—It is pointed out that "Jonathan" and Power's Fife grown in this paddock are not comparable with wheats in No. 1 Paddock, the former (No. 2) being sown a month later, viz., July. Less lime to the acre was used. The soil was in bad order owing to grass-roots not having properly rotted, although everything possible was done to get it into condition, as seed was here, and required to be put in. It was, however, valuable, besides giving us an increase of seed much required for next season; it was also an experiment, showing the difference in yield, which was about 10 bushels to the acre more in No. 1, owing mainly to earlier sowing, the land of which was worked almost as fine as a well-kept garden-bed, and the other rough enough for anything, though equally as well ploughed.

Throughout the presence of old roads and other depressions were detrimental to our wheat yields, and they could not be cut out nor filled in this year. "Bobs," "Lambrigg White Lammas," "Hybride du Trésir," Field Marshal, Nutcut, Cleveland, John Brown, and Jonathan suffering most, but in no case, I think, did these lessen the yield more than 3 bushels to the acre. Parrots also did some damage to Cumberland, John Brown, Bobs, and Jonathan. "Jonathan" had the worst chance of all, and the low yield this year, I am sure, is not a fair idea

as to what this wheat will do in the future, its comparative freedom from rust being a strong recommendation.

This is the first year of cultivation on this farm, the first sod being turned on 19th January, 1904, immediately after heavy green timber. Deep ploughing, frequent harrowing, and lime helped us a lot.

SOME NOTES FOR WHEAT-GROWERS.

1. Choice of Varieties.—2. Selection of Seed.—3. Treatment of Seed for Bunt.—4. Manuring.

W. FARRER, Wheat Experimentalist.

I HAVE been asked to prepare some notes on wheat matters, as at this time of the year they may be the means of furnishing suggestions which will be helpful to farmers in connection with the sowing of their crops. To make them somewhat systematic, I shall take a few topics for consideration and shall confine myself to such as I feel, in some degree, competent to deal with. Such matters as the most economical manner of preparing the land or harvesting the crop I shall carefully avoid. The subjects which will be treated are:—

(1) The choice of varieties.
(2) Selection of seed and manner and time of sowing it.
(3) The treatment of the seed for bunt.
(4) Manuring.

It will be noted that in many instances my aim is rather to suggest than to attempt to teach. There are, in fact, very many points in connection with the best manner of growing wheat in our climate which have not yet been tested by experiments in a satisfactorily systematic manner; and for this reason there are very few, if any, in the country who are in a position to teach on the subject. This state of affairs, however, is in process of being remedied; but it will be some years before the results of the experiments in connection with wheat-growing in our dry climate—which have been planned by Mr. G. L. Sutton and myself, and Mr. Sutton is beginning to carry out on the Cowra and Coolabah farms—will be of much value for this purpose. For the present, therefore, I can give nothing of greater value on such matters than personal opinions; and their worth is, of course, very uncertain. I will now proceed to discuss the subjects I have mentioned.

Varieties to Select.

The conditions under which wheat is grown are so varied that it is absolutely necessary for farmers to have at their command a large number of varieties to select from. The difficulty is to get a selection which, while the varieties it includes differ widely in all other respects, have in common the quality of producing grain of a sufficiently even character and sufficient excellence to cause a consignment of wheat

from the State to be accepted with confidence and command a high price in the world's market. This is a matter which I am trying to look after; and it is for that reason that I shall begin by pointing out what varieties ought, in the interests of the State, to be avoided. At the head of the list I will place Ward's Prolific, a variety which a few years ago was, and probably is still, rather widely grown. The Ward's Prolific which I mean has open brown or amber heads and yellowish grain and a cup-shaped habit of growth. This wheat has some very valuable qualities. It resists rust exceedingly well, and holds its grain firmly. The flour it yields, however, is of a yellow colour with a slight greenish tint, and is very weak. Its gluten, in fact, is of very poor quality. There are several varieties in cultivation which contain more or less of the blood of Ward's Prolific. Amongst them are Budd's Early, Baroota Wonder, Carmichael's Eclipse, Robin's Rust-proof, Golden Prolific, Ward's White (nothing more than a strain of Ward's Prolific with white chaff), Pratt's Pearl, and Phyllis's Marvel (or Marshall's No. 4), only a few of which, however, are known in this State. As, with very few exceptions, my efforts to get rid of its undesirable milling qualities from crossbreds containing even a very small proportion of the blood of Ward's Prolific have, speaking generally, been markedly unsuccessful, I recommend farmers to look with suspicion on all the varieties in the above list. Marshall's No. 3, also, contains some of the blood of this wheat, but it has been fortunate in inheriting little, if any, of its milling inferiority. A variety which first came into my hands under the name of Wilkinson's Early Prolific, the real name of which is Gluyas's Early, looks by its heads as if it contained blood of Ward's Prolific. In the mill, however, it behaves quite differently; and its flour, although of very poor strength, is of excellent colour. This interesting variety is likely to be heard more of in this State, for it is an excellent resister of rust and is early; but it is spoiled by the weakness of its straw. Other varieties which my list shows to be undesirable are Early Baart, Leech's Talavera (from the Tenterfield district) and Sicilian Square-headed Red. These ought all to be carefully avoided. Amongst the better-known sorts, Allora Spring is scarcely up to the mark. It would be well for a farmer, before he admits any variety into general cultivation, to see that its milling qualities have been found to be satisfactory, or to send it down to the Department to be examined. Again, there is another class in regard to which I would like to say a few words. It consists of such varieties as Steinwedel, Farmer's Friend (which is apparently only a strain of Steinwedel), Hudson's Early Purple Straw, Steer's Early Purple Straw, Dart's Imperial (or Chant's Prolific or Bluey), Rattling Jack, Fillbag, White Tuscan, the common Purple Straw, White Hogan, most of the strains of White Lammas, White Essex, Australian Talavera, Steinlee, Zealand (or Berthoud), Jade, Outpost, and Allora Spring. All these (with the exception, possibly, of Allora Spring) produce flour of excellent colour and texture, which, when it is mixed with a moderate proportion of Manitoba flour, makes most attractive and excellent bread. These varieties are all good yielders under our conditions. They are all, however, weak-flour sorts and

exceedingly liable to the attacks of fungoid parasites, and especially of both rust and bunt. Although bunt very seldom, and then only when the seed is very dirty and treatment of it with a fungicide has been omitted, occasions very severe loss in a crop, the aggregate of the small losses, direct and indirect, which are caused by this pest is very considerable, and in most districts probably much greater than is caused by rust; for not only is a considerable portion of the seed when it is treated usually killed by the fungicide, but there is nearly always some, and sometimes a considerable amount of, bunt in a crop which has been grown from treated seed. Bunt, therefore, is a factor of importance that is to be reckoned with; while rust is admittedly a very important one, and in a moist season is liable to cause the total loss of what, but for it, would have been a splendid crop. That a variety should be liable to one of these pests is bad enough, but that it should be liable, as the varieties included in the above list all are—and, more than that, exceedingly liable to both of them—surely makes it to be that our farmers ought to be anxious to replace them by varieties which are more free from at least one of these two defects. This, of course, is a farmer's own business, but it is a matter which it is worth his while to at least think about. Some of the wheats in the above list, of course, deserve to be retained on account of their excellence as hay-wheats. The best for this purpose are, probably, White Hogan, all the White Lammases, White Essex, White Tuscan, Australian Talavera, and Jade. Some of the newer varieties possess much the same milling and other qualities as the best of the above list; and although they are bunt-liable, they are all less liable to rust. These new varieties are Schneider, Plover, Cumberland, and Federation, the last being the most rust-liable of the four; while others, such as Sussex, Tarragon, John Brown, Bobs, and Jonathan, all of which also are relatively good resisters of rust, produce flour which, while practically it is of equally good colour and texture, is of much better strength.

I may mention that it has been found desirable to divide wheats into three classes, according to their milling qualities. These classes are: (1) weak-flour, (2) straight-flour, and (3) strong-flour varieties. The weak-flour sorts are those which yield flour of no higher strength than the best of the Purple Straw class. The flour of the straight-flour class is similar to that which would be yielded by a mixture of weak-flour grain to 100 parts of which from 10 to 150 parts of Manitoba grain have been added. The strong-flour class includes the Manitoba varieties (the Fifes and red Blue Stems), and those which are of greater strength than the best of the straight-flour class. In discussing the suitability of varieties for different districts, when "(1)" is placed after the name of the variety it means that it is a producer of weak flour, *e.g.*, Purple Straw (1); "(2)" of straight flour, *e.g.*, Bobs (2); "(3)" of strong flour, *e.g.*, Power's Fife (3).

The high table-land districts, *e.g.*, those about Glen Innes, Armidale, Blayney, Orange, and Monaro, are the best for the Manitoba wheats, Fifes (3) and red Blue Stems (3), but it is doubtful if these wheats are the best for them. The Manitoba wheats, however, are, as a rule,

excellent resisters of rust and good hay wheats. The variety which yielded the best at Glen Innes last season was the new crossbred Sussex (2) with 34¼ bushels; next to it came Tardent's Blue (1) with 30½ bushels. The rust-resistance of Sussex has not yet been determined, but it is believed to be very fair. Sussex and Tardent's Blue are both suitable for making into hay, the latter being somewhat the better for this purpose. Jonathan (2 or 3) and Blount's Lambrigg (2) are varieties which have given good results in the higher table-land districts, and both resist rust satisfactorily in them; but the Purple Straws and Tuscans are there "off their run," and liable to suffer from rust. For the table-land districts with a somewhat lower elevation, such as Inverell, Quirindi, Tamworth, Manilla, Mudgee, Molong, Bathurst, Garland, and Yass, such varieties as Lambrigg White Lammas (1 or 2), Jonathan (2 or 3), Bobs (2 or 3), Plover (1), Schneider (1), John Brown (2 or 3), Tarragon (2), Sussex (2), Nonpareil, and Field Marshal (1), are all suitable. Of these the best rust-resisters are probably Jonathan (2 or 3), Bobs (2 or 3), and John Brown (2 or 3), while all the others have thus far behaved like very fair resisters. The best for making into hay are Lambrigg White Lammas, Nonpareil, and Tarragon; but the others are all suitable for that purpose. Bobs does well in the northern districts at all elevations, and especially at places below 3,000 feet, unless it be in the flat country where it has still to be tried. It is a good, but not a very good, rust-resister; but is very liable to bunt.

For the warmer western slopes, which include Warialda, Gunnedah, Boggabri, Dubbo, Narromine, Wellington, Forbes, Parkes, Grenfell, Young, Cowra, Wagga, Gundagai, Albury, and Corowa, the most suitable, in addition to Bobs (2 or 3), (which, as I have said, is especially suitable to the north) are Federation (1 or 2), Schneider (1), Plover (1), John Brown (2 or 3), Marshall's No. 3 (1), Nonpareil, and Cumberland; in addition to these, the macaroni wheats, of which the varieties Kubanka, Belotourka, Cretan, Velvet Don, and Farrer's Durum are well worthy of a trial. I may remark that the use of the flour of macaroni wheats for bread-making is coming greatly into use in both southern Europe and America. A prominent miller, also, in Sydney tells me that in England he often made flour from Russian macaroni wheat, and that he regarded it as excellent for mixing purposes. The bread which is made from macaroni-wheat flour is said to have, in a superior degree, the qualities of good flavour and of not becoming dry quickly, while it forms a stronger food than that which is made from bread wheats. Of the wheats mentioned above, Federation (1 or 2) is probably the most liable to rust. The shortness of its straw also unfits it for a hay wheat. The others are all good for making into hay. Cumberland being probably the least suitable for that purpose.

For the country and plains to the west of Warialda, Gunnedah, Narromine, Forbes, and Wagga I know of no bread-wheat which is likely to be more suitable than Federation (1 or 2) which, although more rust-liable than I would like it to be, is early enough to be rust-escaping, and holds its grain so firmly as not to be injured by very

strong winds. Federation has short straw, and on that account appears to be more productive of grain. Its shortness of straw, in fact, as I have already said, is such as to make it of little value for a hay-wheat, and on that account the alternative of a hay crop is not available in the event of its failing for grain. I do not, however, look forward with much hope to bread-wheats being profitably grown in these dry districts. This is the country for macaroni wheats, and I would urge those to whom the agricultural development of our interior is a matter of interest to do what they can to get these wheats tried in it. Our Department is now in possession of seed of several varieties, the flour of which ought to be suitable for bread-making, and is willing to distribute it.

The remaining subjects in my programme are those for which it will be necessary for me to become possessed of experimental *facts*, on which to base opinions, before what I say can have much weight.

Selection of Seed, and Manner of Sowing it.

While there can be no doubt that the planting of the finest seed gives the best results, it is doubtful if the benefits which are attached to it are sufficiently great to justify a large expenditure on machinery for grading the seed; and there are compensations attached to the use of imperfectly-graded seed. In the first place, I think it is extremely doubtful if the largest seeds possess the highest vitality. A year ago some commercial bulks of macaroni wheats from North Africa came into my hands, and in them I noticed some very fine and large grains. These I picked out from four bulks, from which respectively 9, 10, 10, and 12 seeds were taken. These seeds, in common with all the others which I planted from these bulks, were treated immediately before planting with a solution of formalin; but I took care that it was too weak to injure their vitality. From these four lots, respectively, of extra fine seeds, 1, 0, 1, and 0 seeds grew, while from the seeds of a smaller size "the stand" was, although not good, very much better—probably from 40 to 50 per cent. If large seeds exclusively are sown, as, of course, there are relatively few of them in a bushel, the number of plants is much smaller than when seeds of good average size are sown, and very much smaller if they behave as the above large seeds did. The amount of grading which is best and most economical (taken in its true sense) is to my mind still an undetermined question. I can only say that if I were a grower on a large scale, and possessed a grading machine, I would use it to get rid of the small grains. I would also separate my wheat into different sizes, and, selecting some even land, would sow plots of two acres with seed of each of the different sizes; and after doing this for three or four years, would strike an average of the results, and afterwards, in my practice, make use of the information thus gained. If, however, I was without a grader, and had the money to spare, I would most likely get one; but if my banking account was low, I would wait and keep an open mind. For one class of farmers, however, I look upon a grader as an indispensable implement. In the western portions of our wheat-growing districts, the surface soil at seeding

time is often very dry, and seed placed at the usual depth is apt to malt and be lost. In these districts deeper planting is necessary, in order to reach moisture enough to ensure germination. The plantlet then has to make its way through a greater thickness of soil before it reaches the surface, and can begin to get food for itself. In this case its seed-mother has to feed it for a longer time, and in order to be able to do so must have a large endosperm, or be of large size. My custom, in growing experimental wheats, is to plant them by hand at even distances apart, in drills from 2½ to 3 inches deep. Under these conditions, it is easily noticed when a seed has failed to germinate. I have frequently—probably hundreds of times—tried to discover the cause of a seed not having come up, and in the vast majority of cases—probably in over 90 per cent.—have found that it had germinated, and that the plantlet had been unable to penetrate the thickness of soil above it. In the majority of such cases I have been able to save the plantlet's life by uncovering it. To the farmers, then, of our arid interior I would say, "Grade your seed, and reject for planting all that is not up to a good standard of size, and see that your drill deposits its seeds at a not less depth than 2½ inches." For our interior a large size of grain will probably be found to be a necessary quality of a suitable variety. Mr. Sutton and I have in our lists of experiments some to determine the relation between the size of the seed, the depth of planting, the character of the soil, and the percentage of plantlets which reach the surface. The outcome may be a recommendation to plant deeper in dry districts than is done now, and to use a greater amount of seed to compensate for failures to reach the surface.

I would also suggest to the farmers of our interior to give a trial to press-drills; and, if the seeding is done when the soil is dry, to run a heavy roller over the ground immediately after the drill, and to follow it with a smoothing-harrow.

With regard to the time of sowing, my opinion (which of course has, as yet, only the value of an opinion) is that where late frosts are liable to occur, very early planting of early sorts is too risky. A case came under my notice last season where Bobs, on account of having been sown too early, was found to be mounting up too soon, and on that account was rolled. A result which followed was that the first crop of stalks died back, and the diminished crop, which was harvested, was produced by new stalks. In this case, I think the right thing was done under the circumstances; but it would have been much better if the circumstances had not been allowed to occur. At Coolabah, also, where very early sowing was practised, some of my crossbreds were found to be too early for this very reason. It appears, therefore, to be unsafe to sow early sorts very early. Again, if late sorts are sown very early, and the seeding is very thin—a main advantage attached to very early sowing, and a reason why it is practised is the saving of seed—they stool enormously, with the result that a set of roots has to fill a great number of heads with grain. If the soil contains plenty of moisture when the seeds are being formed—and this is usually the case in deep soils—all is right; but if a dry spring succeeds a winter in which stooling

has been vigorous, a plentiful crop of heads more or less badly filled with inferior grain is apt to be the result. This I have observed to occur over and over again in my experimental plots, where the soil is not deep and the plants have plenty of room for stooling. My present opinion is that early, but not very early, sowing is the safest, and that it is safer to seed moderately thickly—thickly enough to prevent overmuch stooling—rather than so thinly as many are now beginning to practise. A suggestive fact which has been brought to my notice is that in the interior of India, the climate of which that of our interior more nearly resembles than it does that of England, and where every reason exists for economy in the use of seed, the standard quantity to sow per acre is 1½ bushels. The quantity which I would sow if I were a wheat-grower, with a holding on our western slopes, would be with a drill—and I would take care to have one—from 35 lb. to 55 lb. per acre, according to the time of sowing. If I could get a drill with spouts only 6 inches apart, I would prefer it, and do anything I could in reason to prevent overmuch stooling. I would also try to do my seeding between the middle of April and the middle of May, and would object to beginning before April 10th, and to going on after June 10th. On the high table-lands later sowing is, of course, permissible. The above are only opinions, but I have tried to present them in a suggestive manner. The schedules which Mr. Sutton and I have prepared include experiments for determining such points as the relation between the time of sowing and quantity of seed per acre, the depth of sowing, the best time for sowing, the relation between the size of the seed and the depth at which it can be safely planted, &c. We do not expect to become possessed of a sufficient number of results (*facts*) to justify our speaking with any degree of authority in less than six years, and probably ten. The results, however, of our experiments will be made public from year to year.

Treatment of the Seed for Bunt.

This is a subject which is engaging much attention at the present moment, especially in America. It is felt that all treatments of the seed which necessitate its being wetted are too inconvenient, and on that account unsatisfactory; and attempts are being made to learn how best to escape having to do this. I, too, have on hand a research for that very purpose; but the method I am working at is of an entirely different character from those which are being tested in America; but of this I shall speak further on. The treatments of the seed which are in practical use are wetting it with a solution of (1) bluestone, and (2) formalin. The treatment with hot water, although it is probably the most efficient, I shall not discuss, because of its unwieldiness, and because, if it has to be used on a large scale, it demands too much of the master's personal attention, and causes him to be too dependent upon the faithfulness of others, if he cannot look after it himself. The treatment consists of keeping the seed immersed for ten minutes in water at a temperature of between 130° and 135° Fahr.; and I know how difficult it is, at any rate when seed is treated on a small scale, to keep water for that length of time between these

temperatures. Immersion in a solution of bluestone is very fairly effectual, but not quite certain. An advantage which is attached to the use of this fungicide is that after the seeds have been wetted by it and have become dry, they have a thin film of bluestone on them, and this protects them to a considerable extent against getting infected afresh. Treatment with bluestone, however, usually kills a greater or smaller proportion of the seeds; and of those which are not killed, many are injured to such an extent that the plants they produce are too weak ever to do much good. When bluestone is used, I recommend a solution of 1 to 80, or 1 lb. of bluestone to 8 gallons of water; and the grain to be freed from contained bunt balls by means of a blast, or by making them float on water and skimming them off before it is treated. The method of treatment consists in immersing the grain by letting it down, two bushels at a time, in bran or chaff bags into the solution, and keeping it immersed for five minutes. During that time the bag should be moved frequently. The seed can afterwards be dried by hanging the bag in a draughty place, or, better still, by spreading it out on tarpaulins. If formalin is used, because this substance leaves no protective film on the seeds, the grain should not fail to receive precisely similar treatment before immersion, and be immersed in the same manner and for the same length of time in a solution made by adding the contents of one of the 1lb. bottles, in which formalin is sold, in from 40 to 45 gallons of water. If formalin be used in this manner, the vitality of the seed will be less injured than by the bluestone treatment, but it is doubtful if it would be advisable to allow the bag to drain into the vat after a charge is taken out, on account of the danger of the solution becoming too weak. In any case, care should be taken not to allow the solution of formalin to be prepared too long before it is used, and certainly not longer than a day. Corrosive sublimate in a weak solution is also efficient for killing bunt spores; but this substance is such a dangerous poison that I cannot recommend its use. With regard to the efforts which are being made to kill bunt spores in a sample of seed without wetting it, satisfactory results are following the experimental efforts which are being made by Professor Wheeler, of the South Dakota Experiment Station. The method he is working at is that of exposing the grain, previously freed from contained bunt balls by means of a blast, to currents of formaldehyde vapour. Formaldehyde, I may mention, is the gaseous substance which, dissolved in water, constitutes formalin. This treatment, if a successful and economical practical application of it can be devised, will be pretty certain to necessitate the purchasing of expensive appliances, and to require much labour and time. The method of overcoming this pest which I am working at is that of making varieties of wheat which will offer such a degree of resistance to the infection of the parasite as to be valuable on that account. If I could make them to be so resistant as to be actually proof against the infection, the necessity for any treatment whatever would of course be done away with. I shall only attempt at this writing to give an idea of the degree of success that my efforts have thus far met with; but as the

subject is a very difficult and complex one, and involves much labour, and I have only been working at it for four years (one of which, viz., 1902, was an "off" year, in which the drought not only made what results I secured to be of very little value, but caused a great loss of valuable seed), it would be, I think, too early to expect a greater degree of success than I have secured, even if my efforts were destined to be completely successful. In testing the bunt-resisting power of a sample of wheat, my practice is to make the seeds as black as it is possible to make them with spores, and to plant them in that condition. This, I need hardly say, is a degree of infection which is never seen in seed which is sown for a crop. In taking results, my custom is to consider a plant to be bunty if even a single bunty grain can be discovered in a single ear. I ought also to state that the proportion of bunty plants (of plants which have taken the infection) is much smaller if the planting be done when the ground is dry or cold, or both, than it is under the opposite conditions. Much depends, therefore, on the conditions under which the planting is done. Again, I have found that if bunt-infected seed, taken from the same sample, even if it be the produce of a single plant, is tested at the Bathurst and Wagga Farms and here (at Lambrigg), the greatest proportion of bunty plants is almost invariably produced at the Wagga Farm, and the smallest at Bathurst, and that the differences between the results at the three places are sometimes very considerable. It is necessary, therefore, in dealing with results secured at Lambrigg, to see that they are confirmed by those at Wagga. The differences, also, at Lambrigg between the results given by samples from the same bulk which have been planted early (before the ground has become very cold) and those which are planted when the soil is at its coldest, are usually considerable. For these reasons, I have to be careful, in comparing the results of planting bunt-infected seeds, to see that the plantings have been made under as similar conditions as possible. If Table V in Bulletin No. 633 (and on page 211, *Agricultural Gazette,* March, 1903), which contains the results of my experiments with bunt in 1901, be examined (the table is too long to be reproduced here), it will be seen that twenty-two varieties planted in June produced an average of 85·1 per cent. of bunty plants from infected seed planted so late as between the 19th and 30th June. We have also seen that we have good reason for thinking that if the planting had been made at Wagga instead of at Lambrigg, this proportion would have been materially increased. The largest percentage which entered into this average was from Hurst's White Lammas, in which every plant was found to be bunty, and the smallest from Hudson's Early Purple Straw, which only gave 36·38 per cent. of bunty plants ; but as I had reason for thinking that this latter result was a misleading one, and that the seed which was planted had probably not been well infected, I tested the bunt-resisting power of Hudson's Purple Straw again in 1903, and found that my suspicions were justified. I will now refer to my Field Book of 1904, and take from it, and give in a table, a few of the best results which have thus far been secured. Whenever seeds from the same packet were planted

at Wagga, or at both Wagga and Bathurst, as well as at Lambrigg, the results which were secured at these farms are given in columns of their own. As the wheats which gave these results are partially fixed crossbreds, and are still without names, I shall designate them by the numbers of the drills in which they were grown at Lambrigg; for the pedigrees of most of them are too long and intricate to be conveniently printed.

In this table, the first column gives the number of the drill in which the crossbred was grown at Lambrigg in 1904, the second, third, and fourth the percentage of bunty plants which were yielded at Lambrigg, Wagga, and Bathurst respectively, from infected seeds taken from the same packet; the fifth column gives the average of these results, and the sixth the percentages of bunty plants which were contained in the drill grown at Lambrigg in 1903, from which the seeds planted in 1904 were taken.

TABLE giving percentages of Bunty Plants.

No. of Drill.	At Lambrigg, 1904.	At Wagga, 1904.	At Bathurst, 1904.	Average, 1904.	At Lambrigg, 1903.
18 (a)	6·0	9·0	4·0	6·3	11·9
19 (a)	3·3	10·3	0·0	4·5	11·9
24 (a)	4·9	7·9	0·0	4·3	4·8
34 (a)	2·3	4·9	2·4	3·2	7·5
+58 (a)	8·5	9·0	.....	8·8	14·9
+13 (b)	10·8	2·4		6·6	32·1
17 (b)	1·2	4·1	5·6	3·6	2·3
30 (b)	6·0	8·1	3·7	5·9	6·9
+44 (b)	0·0	9·8		4·9	24·0
47 (b)	1·0	5·8		3·4	0·0*
+48 (b)	2·2	9·3		5·75	5·9*
+49 (b)	1·3	14·3		7·8	4·8*
+59 (b)	1·3	12·8		7·05	20·4

* Only a few seeds were planted in 1903, and they were planted late.

These results are taken from drills, each of which contained about ninety plants. In all the cases given in the above table the seeds were planted earlier than June 19th, except Nos. 58 (a) and 59 (b), which were planted on June 20th: Nos. 18 (a), 19 (a), 24 (a), 34 (a), 13 (b), 17 (b), and 30 (b) were planted in May; and Nos. 44 (b), 47 (b), 48 (b), and 49 (b) on June 7th. In those cases in which the number of the drill is marked by a prefixed "+," the results, which were secured in 1904, are of the second infection; in all the others they are of the fourth. It will be noted that in all the cases (except 48 (b) and 49 (b), when the seeds planted in 1903 were few in number and planted late), in which the seed had only been infected for two generations, the proportion of bunty plants is much smaller after the second than after the first infection. The above table shows that we have good reason for hoping that something substantial may be done in the way of overcoming bunt by making varieties of wheat which resist infection by the parasite. The investigation, however, is very laborious, and will take a longer time than I am likely to live. That I am now in a position, however, to select bunt-resisters as parents for crosses is in the direc-

tion of helping matters on. Crosses for the special purpose of securing bunt-resistance were made this last season (1904) for the first time.

The last subject I have on my list is that of

Manuring.

The system of drilling in small quantities of superphosphate with the seed, which is recommended by some, and which is being increasingly followed by farmers, is not one which I think ought to be adopted off-hand or with confidence. I consider, however, that this fertiliser is competent to help us on, and for the present I recommend the cautious use of it, if it be clearly understood what good—and what good alone—is to be expected from it. Superphosphate evidently does for the young wheat plant what it has long been known to do for the young turnip plant. It gives it a good start, and that for the plant is half the battle. It must be clearly understood, however, that this fertiliser alone is far from being competent to furnish the crop with all the food it requires, or that a dressing of 50 or 60 lb. supplies even as much phosphoric acid as a moderately good crop takes from the soil; also, that in giving the plant the vigour it does it enables it to exploit the soil more thoroughly for food—to graze it, in fact, very closely. So long as the soil contains plenty of organic matter, and so long as the decay of this organic matter, and the action which it has on the other constituents of the soil in liberating plant food from them, continues, all goes well, and the soil is likely to be fairly productive, and to continue to be productive, in a diminishing degree.

Mr. Sutton and I have included in our schedule of experiments some which will disclose the actual effects on the soils with which we are dealing of a course of manuring in this manner. Amongst our experiments we have some also by means of which we hope to find that this system, in conjunction with special methods of managing the soil, may be carried on successfully.

SEED WHEATS FOR DISTRIBUTION IN TRIAL LOTS AND FOR SALE.

THE following new varieties of wheat produced by the Department of Agriculture may be obtained in small trial lots on application to the Director of Agriculture by any person interested, who will give them a fair trial and report results at the end of the season:—They include varieties known as John Brown, Schneider, Plover, Tarragon, and Sussex. The first three are suited to warm and fairly warm districts. John Brown resists rust very well, and has hitherto proved a heavy and reliable cropper. It is a good milling

wheat, and gives a strong flour. Schneider and Plover are very similar to Purple Straw, but superior in respect to being able to resist rust. They have also a superior yield of grain. They are also excellent hay wheats. Tarragon and Sussex are suitable for high lands and cold districts. Both are reported to be strong resisters of rust, and heavy croppers, Tarragon having given the highest yield of the season at the Bathurst Experimental Farm, with 38¾ bushels per acre; and Sussex the highest at Glen Innes Experimental Farm, with 34½ bushels per acre. Both are good milling wheats, and produce sufficient straw for hay purposes. In addition to above, the following have been well tested and favourably reported on:—

Bobs.—Fairly hardy wheat, rust resister, quick grower, good cropper, fine milling; also, good hay wheat; a great favourite.

Jonathan has all the good qualities of Bobs, holds its grain better, withstands dry weather; also, a good hay wheat; suits almost any district, and much liked.

Federation suits warm districts, fairly short, clean straw, holds grain well, good cropper, fine plump grain; liked by millers.

Cumberland.—Reported rust-resisting, quick grower, good yielder, and well liked; also suitable for hay.

The following standard varieties are also grown by the Department for seed purposes, and may usually be obtained at a small advance on market rates:—

Australian Talavera	**Hudson's Early Purple Straw**	**Tardent's Blue, or Velvet.**
Berthoud or Zealand	**Lambrigg White Lammas**	**White Essex**
Farmers' Friend	**Power's Fife**	**White Hogan**
Field Marshal	**Steinwedel**	**White Tuscan.**

MACARONI WHEATS.

Belotourka	**Farrer's Durum**	**Medeah.**
Cretan	**Kubanka**	

PICKLING SOLUTIONS.

BLUESTONE or sulphate of copper, also called blue vitriol, is best dissolved by hanging a bag of crystals powdered up in a bran or chaff bag just below the surface of the water. The proportions vary from 1 lb. sulphate of copper to 5 to 10 gallons of water for total immersion in bushel lots—allow 1 gallon solution to a bushel. When the pickling is done by sprinkling the solution on a heap on the floor and shovelling back and forth, 1 lb. to 1 gallon, and allow 1 pint to each bushel as used. The former method is the better as a preventive for bunt; the latter the cheaper and more expeditious, but is not recommended.

Formalin is formic aldehyde gas dissolved in water. Water absorbs 40 per cent., and this should be the strength supplied by the vendor. Should there be any reason to believe that the formalin is a poor solution, a sample should be sent to the Department for analysis; but, to save time, buy from a reputable firm a recognised brand, 40 per cent. strength. Use 1 lb. formalin to 35 to 45 gallons water. One bushel absorbs about 1 gallon of solution in the steeping.

1 gallon water weighs 10 lb.
1 pint water = 20 oz. or 1¼ lb.
1 bushel wheat for these purposes taken at 60 lb.

Weeds of Bathurst District.

[Continued from page 341.]

R. W. PEACOCK.

Fat-hen, or White Goosefoot.

[Botanical name, *Chenopodium album*, Linn. Introduced from Europe.]

It belongs to the natural order Salsolaceæ, and is one of the commonest weeds upon the richer agricultural lands. It revels in rich soil, gardens, and places containing large quantities of vegetable

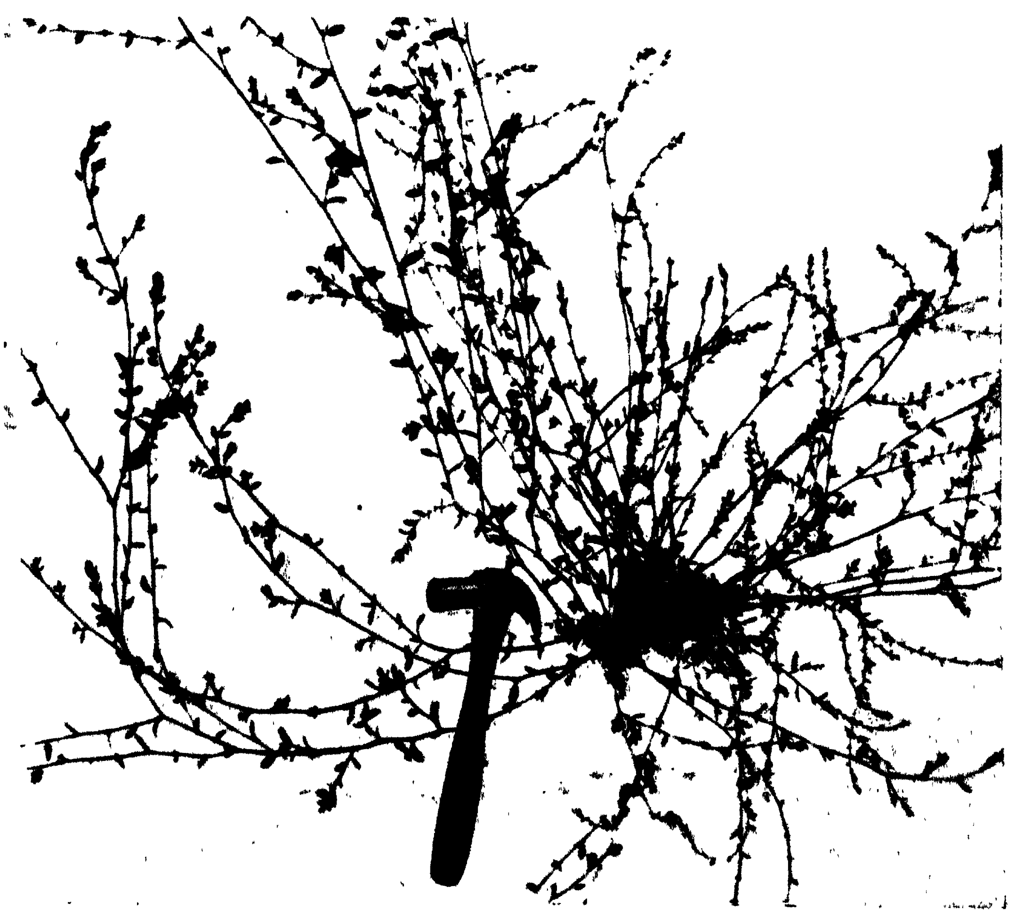
Fat-hen

matter, as upon old stack sites, &c. It grows to the height of 7 or 8 feet, and seeds profusely. It is an annual, the young seedlings coming up so thickly in the spring as to choke the crops, unless vigorously attacked with the hoe. It does considerable damage in newly-sown lucerne paddocks, and should be mown before getting very high, otherwise the young lucerne plant is drawn in its attempt to get to the light, and may eventually be smothered. The amount of moisture taken out by the weeds is considerable. In paddocks badly infected an autumn-sown cereal crop should be sown thickly to smother it, or other crops allowing of the thorough working of the land throughout the spring should be sown, preferably a hoed crop. Cattle and sheep eat it readily, and, although not to be classed as a good fodder, will keep it in check where they can have access to it.

Knot-weed, or Hog-weed.

[Botanical name, *Polygonum aviculare*, Linn. Introduced from Europe.]

It belongs to the natural order Polygonaceæ. It is a most troublesome weed, being extremely hardy; its long tap-root allows it to thrive under adverse conditions, and makes it troublesome to eradicate



Knot-weed, or Hog-weed.

by light cultivations. It interferes considerably with wheat, lucerne, and many other crops, robbing them of moisture which they can ill afford. It seeds freely, which germinate almost at any time. Where prevalent upon wheat lands, the seed should be sown rather thickly upon very freshly worked soil, under favourable conditions for germination, to allow of the wheat getting the start. If the land is ploughed well to a depth of 6 inches, the fine weed seeds are placed at a disadvantage. Under such conditions the surface should not be worked too fine, as a fine seed-bed encourages the germination of weed seeds, whereas the wheat will thrive upon a rougher seed-bed. Stock are fond of it, and it makes a good fodder. Heavy stocking after harvest to prevent it from seeding, to be followed by the plough as soon as possible, are to be recommended for its eradication.

IN the *Agricultural Gazette*, April, 1905, page 340, an illustration appears with the title, "STAR THISTLE." This should have been "BLACK OR SPEAR THISTLE," described by Mr. Peacock on page 339 of the same issue.

ADDENDA TO FERTILISER LIST IN APRIL *Gazette*.

CORRECTION:—The figures for the nitrogen and ammonia in the bone-dust listed by Mr. M. O'Riordan are wrong. They should read—nitrogen = 3·48 equivalent to ammonia = 4·23, instead of nitrogen=6·97 equivalent to ammonia=8·46.

The following fertilisers, which are listed by the K.P.N. Fertiliser Co., 233 Sussex-street, were obtained too late to allow of their insertion in the April *Gazette*. They are as follows:—

	Manurial value.		
Sulphate of potash—52·46 per cent. potash	£10	8	7
Muriate of potash—60·72 ,, ,, ...	13	13	3
Kainit —12·48 ,, ,, ...	3	5	6
Sulphate of ammonia—20·66 ,, nitrogen = 25·09 per cent. ammonia	13	18	11
Nitrate of soda —15·43 ,, ,, = 18·74 ,, ,,	10	18	7
Thomas' phosphate —17·17 ,, phosphoric acid, of which 9·56 per cent. is citrate soluble	2	8	8
No. 12 Superphosphate, 20·33 per cent. water sol. phosphoric acid, 2·14 per cent. citrate sol. phosphoric acid, 23·15 per cent. total phosphoric acid	5	10	5
Special superphosphate, 42·43 per cent. water sol. phosphoric acid, 1·60 per cent. citrate sol. phosphoric acid, 44·90 per cent. total phosphoric acid	10	19	6

Locusts and Grasshoppers.

The Gryllidæ and Wingless Locustidæ.

WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

Part IV.

No group of insects is better known in the garden, field, or house than the black crickets, and from the social habit of the house-cricket, which by some authorities is supposed to have been originally the same species as the field-cricket, but after taking up its quarters where it could obtain enough warmth to live through the winter of the northern latitudes, it diverged from the type so much, under improved surroundings, as to be now defined as a separate species. Many curious superstitions linger among different nations as regards the song or presence of crickets. The "Cricket on the Hearth," with its clear, sharp trill, is looked upon as a welcome visitor, and has been the theme of many songs and stories; some say the harbinger of good luck to the home it has adopted. On the other hand, some people look upon its loud note breaking the silence of the evening as a sign of bad omen, foretelling a death in the house. In some parts of Italy it is looked upon with love and almost veneration. In the city of Florence, on Ascension morning, the peddlers throng the streets with crickets in little painted cages, selling them at from 2 to 5 cents, and the air resounds with their cries as well as those of the captives. You must pick your cricket with care, for his singing powers or want of them will decide your destiny for the coming year. An active, bright singer means good luck; a sluggish, silent one, the reverse. These caged insects, after being carried about all day, and their respective merits being dilated upon by their owners, are liberated in the evening.

In the North of Africa the natives in the villages make a regular trade in capturing and caging crickets, which they sell in the towns, where they are kept and fed like cage-birds for their song. In China another species is often sold in cages; but they are used like game-cocks for their fighting qualities, and sums of money are lost and won on their prowess. In some parts of England it is still firmly believed that if you kill or injure a cricket that has come into the house, its relations will come into the house at night and eat holes in your clothes in revenge.

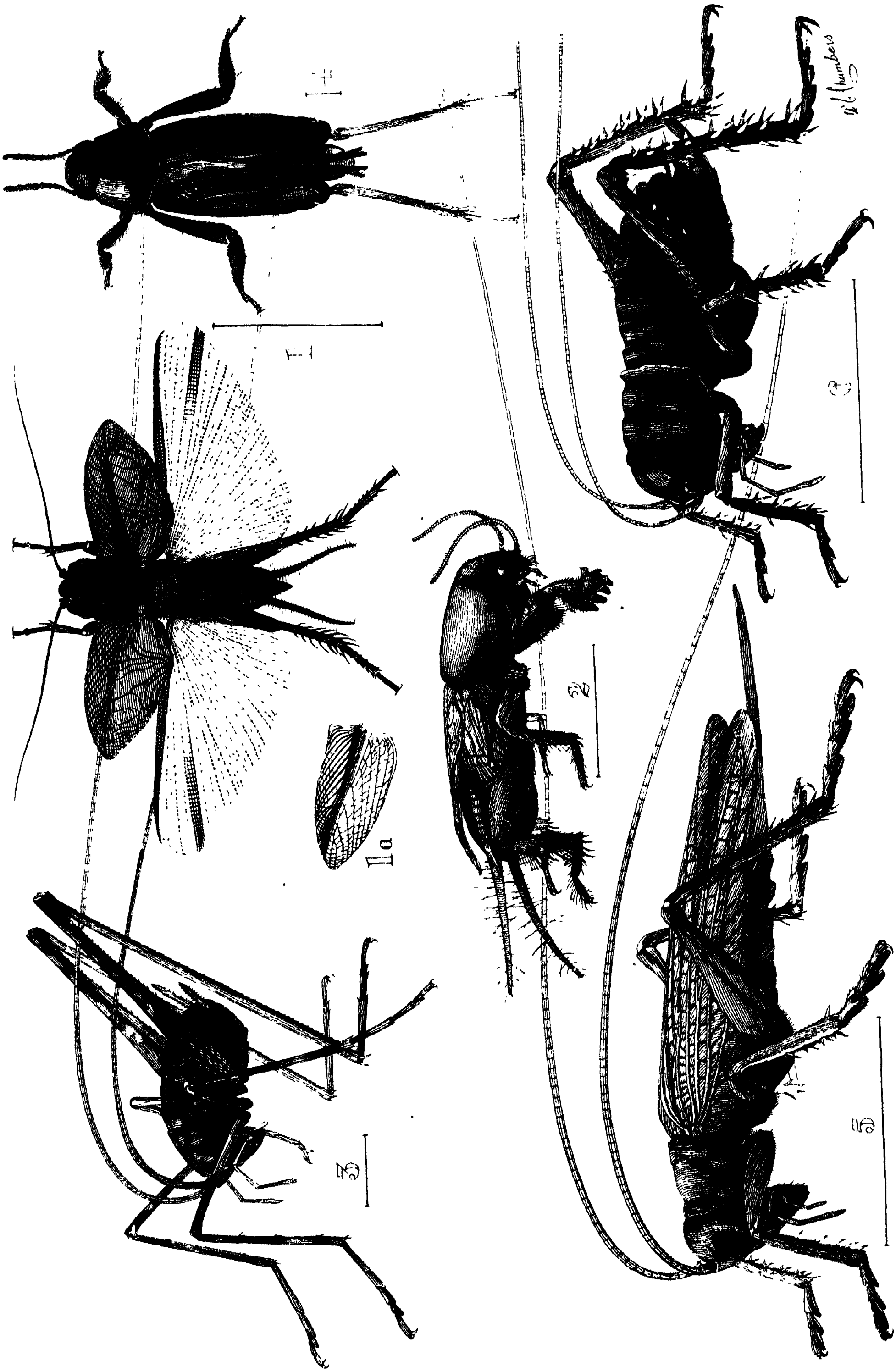
McCook, in his "Tenants of an Old Farm," gives a typical African superstition believed in by the American negroes:—"My mammy—a

Virginny woman she wuz—wunst caught me killin' a cricket. I can see des 's plain 's day de awful look on 'er face es she grabbed me en signed de cross ober me, en den she shuk me tel I farly chattered. 'Doan ye nebber do dat agane, chile,' she said; she was so skeered that she panted for breaf, and could skarcely speak a word. 'I know ye done 't widout a-thinking, but hit's awful wrong to kill crickets, spec'lly dem as 's in dohs; dey's de sperits uv ole folkes, honey!' She drapped her bref en spoke 'n a whisper 'et farly made my blood run cold. 'Dat's w'at des is, chile—old folkses w'ats dead 'n gone, en den come back to sit in dar old co'ner by the kitchen hearth. Dey hadn't otter be harmed, en woe's dem w'at kills 'em.'"

Crickets take their name from the sound of their trill or chirrup, which is produced by the rubbing together of the fore wings, the ridged veins of one wing-cover rubbing over the ridges of the other; this peculiar structure of the forewings is peculiar to the males, the wings of the opposite sex being simple and regular in structure, incapable of producing sound. These insects are solitary in their habits, living in holes or burrows in the ground, hiding in the day, coming out in the night to the mouth of their chamber to sing or to be sung to. They feed upon all sorts of things, chiefly vegetable matter, but are almost omnivorous in their tastes, eating each other when they happen to be imprisoned together; from their habits they are easily destroyed in houses, when they become too numerous, by placing jars or tins half full of liquid, into which they fall and cannot get out, or by poisoning vegetable matter and placing it in their runs. This group of insects is widely distributed all over the world, and in this country are represented by a number of interesting species, some of the brown wingless forms being remarkable for their size and immense jaws; others, living in holes in trees, are remarkable for the length of their antennæ.

There is a group of wingless locusts, closely allied to the crickets, living in the dark in caves, and though they have well-developed eyes, have no ears. They are found in different parts of the world, and, although they are all very similar in general construction, have been divided up into different genera. They are placed in the group *Stenopelmatides*, and one species is common in some of our caves; it is of a uniform mottled brown and yellow tint, with a short oval body, the whole under half an inch in length, but the long slender hind legs and antennæ are over 2 inches in length; they are very active, but never come into the light.

Another curious little group belongs to the genus *Nemobius*; tiny black crickets about one-fifth of an inch in length, with the thorax somewhat like that of a mole cricket, and the thighs of the hind legs very large in proportion to the size of the insect. They live on the edge of the water, and, though provided with wings, nearly always swim out into the water, when disturbed, to escape capture. Perhaps one of the most curious crickets is *Cylindrodes Campbelli*, found on Melville Island, on the North Coast, which is very long and slender, with small thickened forelegs and broad cylindrical thorax; it burrows into the stems of plants and does a great deal of damage.



1 *Gryllus servillei* (*Male*).
1A. „ „ *Fore-wing* (*Female*)
2 *Gryllotalpa coarctata*.
3. *Pachyrhamma, sp.*
4. *Nemobius, sp.*
5. *Paragryllacris combusta*

The Australian Cricket (Gryllus servillei, *Saufs.*).

This is our common black cricket, typical of the group, which has a very wide range over Australia, and, though usually only found in odd pairs, sometimes appear in such numbers that they will destroy great quantities of tomatoes and other garden stuff; every clod or bit of wood covers scores, which hop away with erratic jumps when disturbed; when in such numbers they also often damage the opening buds of vines and fruit trees.

It measures slightly over an inch in length from the front of the head to the tip of the body, with the jointed anal appendages about one-third of an inch longer, and the dual ovipositor of the female about half an inch in length. The general colour is shining black, with the fore-wings brownish, and the hind ones, except two narrow parallel bands, opaline and semi-transparent. The sexes are alike in form, except for the ovipositor in the female and the distinct circular neuration of the forewings of the male, which in the female are simple transverse lines. The head is broad, rounded in front, with flattened circular eyes and long, slender, thread-like antennæ. From behind the head the thoracic segments are of a uniform width, with the abdominal segments tapering to a point, on either side of which spring out the cylindrical tapering appendages called cerci. The front wings are short, broad, and pointed at the tip; the hind pair large, extending considerably beyond the tip of the first pair when extended. The legs stout, with the hind pair furnished with very spiny legs and long tarsi. This cricket has a wide range over Australia. Walker, in his catalogue, gives another eleven species from this country.

The Mole Cricket (Gryllotalpa coarctata, *Walker*).

These insects are the typical miners of the family, and every part of their anatomy is admirably adapted to the subterranean life they lead; of a general cylindrical form, they have small eyes on the sides of the head, powerful jaws, and a large, somewhat elongated, thorax, with short elytra and large hind wings, which are folded over the soft abdominal segments, but differ chiefly from the field cricket in the remarkable structure of the fore-legs, which are short but broad, and flattened out like regular little spades, while the other legs are simple. The males have the inner portion of the elytra parchment-like and roughened with nervures, and produce a regular trill, more modulated and not so shrill as the chirp of the field cricket.

Mole crickets are found in most parts of the world, and are a great pest in Europe in gardens and fields, for though they eat many small worms and other subterranean insects, they also eat the roots of the plants, and do a great deal of damage at times. The female forms a large flask-shaped nest in the summer-time, about 6 inches beneath the surface, in which she lays several hundred eggs, the tiny larvre when they first hatch out are almost white, but after each moult become darker, until at the fourth or final one they don the garb of the adult.

Two species are recorded from Australia—*Gryllotalpa africana*, also found in Africa, Tasmania, and New Zealand (this is the largest species

generally confined to the coastal districts), and *Gryllotalpa coarctata*, originally described by Walker from North Australia, but having a very wide range over the interior. Tepper records it in the "Zoology of the Horn Expedition" from several localities. It is found along the edges of the lagoons and rivers in the interior, in shallow burrows in the soft sand, often quite close to the edge of the water, but probably constructs more elaborate chambers when depositing its eggs. Neither of our species have ever been recorded as doing any damage; but *Gryllotalpa borealis*, which has very similar habits, is said to sometimes damage potatoes in North America.

The Tree-trunk Locust (Paragryllacris combusta, *Germ.*).

This insect takes up its quarters in all kinds of situations, always carefully hidden during the day, sometimes under the loose bark on the tree trunks, among curled leaves on the spathe of a palm frond, but its regular home is in some cavity in the branch of a tree, where it covers the opening in front with a tough white substance of a net or grating-like structure; protected by this it is very valiant, and if disturbed with a grass stalk will come and shake the net with its jaws, as if to frighten the intruder away, at the same time making a distinct sharp sound. It is of a uniform light yellowish-brown colour, with the head, thorax, and legs marked with black, and the anal appendages light yellow. It measures about 2 inches from the front of the head to the tip of the folded wings, and fully 3 inches across the outspread wings. The insects are solitary in their habits, hiding in the daytime and coming out at night, but are very active when disturbed, biting with their powerful jaws when carelessly handled. They have a wide range over Australia. When resting the wings are closely folded—almost wrapped—round the body; when expanded the elytra are somewhat broad and rounded at the tips, with the hind wings very broad and rounded like a fan, and very finely netted with nervures. The head is large, flattened in front, with the eyes almost on the summit of the head, the long slender antennæ, often measuring 4 inches, turned over the back. The legs are moderately thickened and thickly clothed with stout spines.

The Great Wingless Locust (Anostosoma Australasiæ, *Gray*).

This formidable insect lives in the ground close to the surface, and was originally described from Moreton Bay, Queensland, by G. R. Gray, but though not common, is sometimes taken in the gardens around Sydney. They are wingless, with a very robust structure, the female measuring 3 inches in length from the front of the head to the tip of the curled-up ovipositor. The general colour is dark reddish-brown, with the legs, palpi, and antennæ lighter coloured. The head is very large, furnished with powerful jaws, reniform eyes in front of the head close to the base of the antennæ, the slender thread-like antennæ measuring up to 4 inches in length. The fore portion of thorax saddle-shaped, with the legs thick, covered with stout spines along the tibiæ, the thighs of the hind legs swollen and ridged down the sides with transverse lines. The abdomen is large,

rounded on the dorsal surface, with the anal appendages (cerci) small; the ovipositor in the female thickened at the base, and turning upward.

In New Zealand there are several closely-allied wingless crickets; one known by the natives as "Weta-punga" (*Deinacrida heteracantha*) is an immense fellow measuring over 4 inches in length when the legs are stretched out. They live on the branches of the trees, hiding in cavities, and can inflict a painful wound with their stout jaws. This insect once very common, is now rare, as the forests have been destroyed, but several smaller species, also arboreal in their habits, are still common.

The Small Wingless Locust (Anostosoma erinaceus).

This insect measures 1½ inches in length, but is very stout and broad in proportion; it is of a general dark chocolate-brown colour, with the prothorax reddish-brown, the spines on the legs yellow, tipped with black. The head is very broad, rounded at the summit with a white spot in the centre between the base of the antennæ, which is much shorter than those of the previous species. The eyes are light-brown, placed well in front of the head, and the palpi or feelers below are well-developed. The prothorax is very large saddle-shaped, but flanged on the lower edge; the abdomen broadly rounded, slightly tapering to the extremity, with a short curved ovipositor. The spines on the legs very robust, particularly those on the hind tibiæ. These crickets are generally taken in gardens or low scrub, our specimens come from the Blue Mountains.

The Cave Locust (Pachyrhamma sp.).

This curious insect, with its small oval body and long slender legs and antennæ, was taken in the Bendithera Caves, in the Moruya district, by Mr. George Murray, who found them plentiful in the darkest parts of the caves, resting on the walls.

The genus *Pachyrhamma* was formed by Brunner in 1888 for the reception of three species of cave-dwelling locusts in New Zealand.

The Water Cricket (Nemobius sp.).

This little black cricket is common on the edges of the creeks and lagoons about Howlong, Murray River, where they hop about on the sand or mud. Three species are recorded from Australia in Walker's catalogue.

This species measures one-sixth of an inch in length, with the outstretched hind legs measuring nearly as much again. It is of a uniform black colour, with the wings, base of thorax, and legs brownish.

Paspalum Dilatatum.

W. S. CAMPBELL.

THIS grass has attained such remarkable prominence, and so many persons have become acquainted with its value, and so much has been written about its merits, that anything one can write upon the subject seems to be superfluous. However, the Editor of the *Agricultural Gazette* tells me that as there is an inexhaustible demand for information concerning this *Paspalum*, he thinks another article (to be issued in pamphlet form after its publication in the *Gazette*) is desirable, and, as I have been acquainted with this grass pretty well from its introduction in the Richmond River district, he asked me to endeavour to satisfy the demand.

The Agristologist of the United States Department of Agriculture, H. Lamson-Schribner, in his work on American grasses, 1897, gives the following description of the grass thus :—

"*Paspalum dilatatum*, Poir. (p. *ovatum*, Nees.) 'Large water grass.' —A somewhat coarse leafy perennial, growing in clumps, 6 to 15 dm. high, bearing 2 to 10 more or less spreading racemes of hairy spikelets. In meadows, waste ground, and along ditches, South-eastern Virginia to Florida, west to Texas apparently naturalised (South America)."

As far as I can gather this grass has never received any particular attention in America, and does not seem to be thought of as particularly valuable or useful. It was first introduced into New South Wales by Mr. W. Farrer (now Wheat Experimentalist to the Department of Agriculture), of Lambrigg, on the Murrumbidgee, near Queanbeyan.

Mr. Farrer, on being referred to, reports :—"I am afraid I cannot claim to be the first introducer into Australia of this grass; and I think that the credit lies either with Baron V. Müeller or Mr. Bacchus—most likely with the former. However, without any knowledge of its having been previously introduced, I did introduce it in 1888 or 1889, under the older name of *Paspalum ovatum*. I divided the imported seed between the late Dr. J. Bancroft, of Brisbane, and the late Mr. James Henderson, of Kinghorn, Tambourine, Queensland. Unfortunately for my importation, neither of these gentlemen lived long after he received the seed. This much, however, I do know, that the seed I imported grew and did well, for I received some seed which had been grown from my imported seed; and I heard that the new grass was a great success. This grass, however, won for itself the name it enjoys in Australia on the Richmond River; and that which is being grown there and has spread over this country, as well as to others from there, was descended neither from Baron V. Müeller, nor Mr. Bacchus, nor my own seed, but from a stray seed which was contained in a packet of the seed of a grass which Mr. Seccombe

(now residing at Arncliffe) received from Japan when he was residing on that river; and to Mr. Seccombe is due the credit of making public the merits and the true value of this grass. My own experience with it is limited. I have had it growing here since 1890, but our winters at Lambrigg are too cold for it, and cut it down; and it is rather slow in starting in the Spring. My own plants are growing in poor soil, and from being in the paddock in which the killing sheep are kept, are kept eaten down very close; but for all that it is, or, at any rate, the last time I went to look at it, was still there, and has survived close eating and many droughts. In droughts, however, although it withstands them very well indeed, it makes little or no growth; and for that reason is inferior to Johnson grass (*Sorghum halepense*). But in warmer climates, and in soils which are fairly moist, *Paspalum dilatatum* is pre-eminently desirable.

Mr. Seccombe, who is referred to by Mr. Farrer, took a keen interest in grasses, and being an excellent observer, as well as an experimenter, took notice of the seedling grass plant which appeared. From this single plant he gradually increased his stock as much as possible, for it seemed to him to be an excellent fodder plant, and well suited to the district. Mr. T. G. Hewitt, proprietor of the *Northern Star* newspaper, who was (and still is, I am pleased to say) taking a great interest in grasses and economic plants, concerned himself a good deal about the Paspalum. Gradually the farmers took to planting it, and, as its excellent properties became known, the demand for seeds and plants became enormous, and its name has now become familiar to every man woman and child, not only in the Richmond and Tweed River districts, but all over the coastal districts of the State. I am pleased to think that the proper botanical name is used by everyone, in spite of a silly attempt in another State to apply a local name for no good reason whatever.

When I visited the Richmond River district to start Mr. McKeown on the Experimental Farm at Wollongbar, the Paspalum was practically in its infancy there, and we were both much interested in discussing the merits of the grass with Mr. Seccombe. Mr. McKeown very soon had an opportunity of making a thorough trial, and I asked him, for the purpose of this article, to supply me with some information concerning it, and this I feel sure will prove of value.

"My experience with *Paspalum dilatatum* dates back as far as 1893, when I took charge of the Experimental Farm, at Wollongbar. In that district the grass was first grown on the farm of Mr. E. Seccombe, who had been for some time experimenting with grasses, fodder-plants, &c. A small quantity of the grass supplied by Mr. Seccombe was also growing at the council chambers, at Lismore, from which seeds were distributed by Mr. Barkam, the council clerk. Although wherever it was grown it presented a highly attractive appearance, I found the majority of farmers strongly prejudiced against its introduction to their properties, as they expressed the fear that they would not be able to get rid of it if they wished to do so. One man to whom, at his request, I had supplied a number of plants after having seen them make a good start, became alarmed and dug them all up.

"As soon as a portion of the Experimental Farm was cleared, Mr. Seccombe supplied me with a quantity of plants and seeds which were planted in an unbroken paddock, or in plots in the ploughed land. The results in every case were highly satisfactory, the plants in the paddock rapidly increasing, by means of stooling, and the young plants resulting from the seed, which was allowed to shed. In cultivated land the growth was very rapid, test cuttings from plots only a few months planted having yielded as high as 22 tons of green fodder per acre, the lowest cutting of the first growth of any plants having been at the rate of 13 tons per acre. The higher cutting was obtained from plants in beds where seed had been sown, the latter from transplanted sets.

"The grass proved very palatable to stock, which I have known to eat it in every possible stage of growth or form of preparation, as hay, chaff, or silage. When the early rank growth in lightly stocked land had been eaten down, I have seen horses softening the coarse butts by beating them with their hoofs, and eating them in preference to the cocksfoot and other grasses in the paddock. I had a quantity made into hay, which, in the absence of a hay-shed, I stored on poles under the roof of the stables, where it became very dry and unattractive in appearance. It was then used for bedding, and, although the horses were well supplied with the best of chaff and corn, they ate the bedding in preference to the fodder.

"After about a year's demonstration of its growth and usefulness on the Experimental Farm its distribution rapidly increased, as seeds or plants were supplied to applicants from all parts. In almost every instance satisfactory reports of its growth were received, although the conditions under which it was grown varied greatly. The highest elevation at which its success was recorded was at Braemar, on the Southern Line, about 2,000 feet above sea-level, while it did well in all coastal districts to which it had then been introduced.

"At Byron Bay it was reported as being the only variety to thrive in almost pure sea sand. All reports showed it to be resistant to coastal droughts. Just before leaving Wollongbar, in 1897, I planted several 5-acre blocks with various grasses with a view to comparing their stock-carrying capacity, but my removal made it necessary that my successor should make the records.

"I introduced the grass to the Wagga Farm in 1898, where I have since had it under careful observation under varying conditions, but the results have not been satisfactory. The first plantation was made in granitic soil, where the plants made a fair show for about two years, before the extreme heat and drought of summer were experienced. Under these conditions they wilted badly, and with the exception of the outer row they died out. Another plantation was made about three years ago on one of the lowest positions of the farm, in the typical red soil of the district, but for a considerable time plants have been dying off rapidly.

"The grass requires a free soil, so that it may stool freely, and so that such seed as is shed may have a chance of germination; but our soil does not possess this quality, as it sets like cement in hot weather.

After a time the increase in the size of the plants by stooling becomes difficult, and practically ceases, owing to the hardness of the soil, and the stools then make an upward growth, thus exposing portions which under favourable conditions would remain underground. This exposure to a hot dry atmosphere soon causes the death of the entire plant.

"All plants put out in ordinary unbroken grass paddocks died during the first year. Very little seed is produced here, therefore. Stooling is the only method by which the plants can increase, and this means is limited by the conditions already described. The only plantation on the farm which has had an issue approaching success is that consisting of a few plants which were set out in an enclosure, where they receive some moisture from the soakage of a large excavated tank. Here a fair quantity of young plants have grown from shed seed, and all look healthy.

"From the Wagga Farm a considerable number of plants have been sent out to many parts, including Victoria and Tasmania. No favourable district reports have been received, except from Cootamundra and Hay. In the latter district excellent results have been obtained under irrigation. Persons in Gippsland to whom plants were sent have reported very highly of its success there."

Mr. R. Davidson, M.P., of Port Macquarie, is a strong advocate for *Paspalum dilatatum,* which thrives wonderfully well in his district. He has made several successful experiments with this grass, and amongst them was one on a piece of land which is situated on the bank of a tidal stream. It lies just one foot above high-water tide-level: exceedingly swampy, and of but little value. This land he ploughed and harrowed, and then sowed it with *Paspalum* seed. The grass grew very quickly, and soon covered the place, destroying the rushes which abounded there. This land he was then enabled to stock heavily with cattle. The adjoining land was allowed to remain in the same condition as the piece referred to, before it was improved. Mr. Davidson had the two areas valued by a practical farmer. That covered with a luxuriant growth of *Paspalum* was valued at £12 per acre; the other at 5s. per acre. This speaks volumes in favour of this grass for such places.

Mr. H. W. Potts, Principal of the Hawkesbury, has distributed both plants and seeds largely through the State. A circular was sent out to the recipients, asking them to reply to certain questions as to success with the grass, or otherwise. A large proportion of these circulars have been answered, and the replies are extremely interesting and valuable, and I desire here to express the thanks of Mr. Potts and of myself for the information furnished. It would be interesting to publish the replies, but it is not possible to do so in the limited space available for this article. Suffice it to say that in almost all the replies received satisfactory results have followed the trials made, and in places as wide apart as Tenterfield on the high New England table-land, to Bega on the South Coast. Mr. Potts considers that this grass is admirably adapted for pig-feeding. He finds that the boars and sows alike revel in it. He considers that half an acre of *Paspalum* will be sufficient to produce the green feed required by fifty pigs.

From the evidence given above, anyone may draw the conclusion that it would be a wise proceeding to grow *Paspalum dilatatum* wherever it is likely to grow.

Mr. Musson, of the Hawkesbury College, has given a good deal of attention to this grass, and has published information concerning it in the *Agricultural Gazette.*

From the Departmental Stud Cattle Farm, at Berry, on the South Coast, Mr. Quirk, the manager, sent me the following report:—

REPORT of Mr. Hindmarsh, Judge of Paspalum, February, 1904.

Paspalum Grass.

Prizes will be given for the Best Half Acre of Paspalum Grass, to be judged in December, 1903, within the following boundaries:—Gerringong, Broughton Vale, and Berry municipalities, the piece of land bounded on the south by the Shoalhaven River, north and west by the municipalities, and east by the sea; also the unincorporated portions of Meroo, Jasper's Brush, and Bellawongarah. Prizes: First, £5 5s. (specials by Mr. P. Quirk, £2 2s.; Mr. A. Waddell, £1 1s.; Messrs. Yates & Co., £1 1s.; and Goldsborough, Mort, & Co., £1 1s.); second, £2 2s. Four entries or no prize. Entries close 1st December, 1903.

"I beg to submit my decisions for the first and second prizes given by the above Association for the best half-acre of Paspalum plots:—

1. D. Thorburn, Jasper's Brush. 2. John Cook, Woodhill.

"There were seven entries in all. Those on the flats were backward, through, no doubt, the quantity of moisture and the lack of heat.

"Mr. Thorburn's entry possesses a fine sole and a nice height. The land was ploughed about two years ago, sown, and lightly harrowed. It had been allowed to re-seed, consequently the good sole. Mr. Cook's also had a nice sole, and received about the same treatment as the former, but, having a southern aspect, was not as even all through. I consider this grass a splendid pasturage for the cattle grazing on the steep hills around Woodhill and Bellawongarah. It is sweet, and will retain the land from washing away."

"In reply to yours of the 9th instant, *re Paspalum dilatatum,* I have the honor to report that it has passed the experimental stage, and is now looked upon as one of the main summer and dry weather grasses on the south coast. On the Stud Farm we have been growing it for the past four years. We first started with 200 roots from the Hawkesbury Agricultural College. These were planted in a sort of nursery-bed, and, two years later, transplanted 6 feet apart both ways, which covered a 30-acre paddock. This has been growing for two years, and now we are getting it all over the field, with every prospect of a fair sole. I had also sown, three years ago, on a 6-acre paddock—in March, 1902—*Paspalum* seed at the rate of 1 lb. per acre. I would have sown 3 to 4 lb. to the acre, but having only 6 lb. of seed in hand at the time of laying down the paddock with cocksfoot, rye grass, Kentucky blue grass, mixed English and red clover. At the present time, all the grasses have died out except *Paspalum dilatatum,* and this has established a good sole. On the Stud Farm, and all along the coast, we find sowing good seed the best method of establishing a good sole; transplanting the roots entails a great amount of labour; but in the time of laying down new pasture lands, about

March, it would be a good plan to mix (say) 3 lb. of good seed with the other grass seeds; by this method the farmers would have a field of *Paspalum* coming on when the other grasses are dying out. Four years ago many of the farmers on the South Coast condemned *Paspalum,* and said they would not allow a root of it on their farms, and that it was going to be a worse nuisance than the tussocks, and the man introducing it should be flogged; in fact one had to feel his way before mentioning the word *Paspalum,* but now the grass has made converts of many of these men, and they praise it as warmly as they at one time condemned it.

"I was speaking to Mr. H. Graham, of Bellowanga Mountain, a few days past with reference to the drought. He said, "Oh! I'm all right; I have about 60 acres of *Paspalum* as green as the proverbial leek, and knee-deep." This speaks volumes for it in a dry season like the present, and Mr. Graham further remarks: as we cannot grow lucerne, every farmer should have a paddock of *Paspalum* to tide him over a dry season.

"Mr. Woods, of Barrengarry, is a staunch believer in the grass, and has sown it extensively on the mountains, and informs me it is doing splendidly. On the Stud Farm, *Paspalum* is the only grass that is growing at the present time, and many visitors have said, 'How well your farm looks.' This is the green *Paspalum* showing out in the distance on the flats. Many of the farmers remark that it is a creeper. We have 3 acres in the corner of a large grass paddock: the stock makes this appear a creeper, for immediately the cows are out of the bails, they go straight to this corner, and keep it eaten down bare, never allowing it to seed. This shows that stock relish it. As they are good judges, they will eat out the *Paspalum* and leave the rye grass and cocksfoot. To show further that cattle are fond of the grass, the paddock of 30 acres mentioned, sown 6 feet apart with sets, was saved to allow it to seed. Being harvest time, we were carting hay through the paddock the young stock were depastured on. They became a nuisance following the dray, so I turned them into the *Paspalum* paddock for a few days, with the result they went straight along the rows and ate the sets to the ground, although there was cocksfoot and rye grass in abundance in the paddock. Many farmers say they do not care for *Paspalum,* as it is a late grass and does not throw up any growth until November. Now this, on the South Coast, is one of its strongest recommendations, as we have plenty of early grasses and herbage in the early spring and late autumn—so *Paspalum* fills a long-felt want, by providing a splendid summer grass that will pull us through a dry season. *Paspalum* will adapt itself to any conditions; it flourishes on the swampy land and makes good growth on the dry ridges. Mr. Wilson, on the mountain, says it is growing on his farm where grass never grew before."

The *Paspalum dilatatum* has been experimented with far away in the dry west at the Experimental Farm, Coolabah, and Mr. Peacock, who tried this grass, reports as follows:—"In compliance with your request for information respecting *Paspalum dilatatum,* I may state that I found the climate at Coolabah too dry for its successful

cultivation. It grew very well under rather adverse conditions, but the extreme dry weather was too severe upon it." He also reports:—"At the Bathurst Experimental Farm it grows well throughout the summer, and is only a summer grass in this district, the winter being too cold to allow of its making any growth during this period. Its lying dormant for this season allows of the barley grass to get a hold of the land during this dormant season. As a fodder I consider it more suitable for cattle than for sheep, it being somewhat on the coarse side. I consider it one of the most valuable summer grasses for the district, the trouble of planting it out from roots militating against its more extensive cultivation."

Mr. Gennys, Manager of the Experimental Farm at Glen Innes, has not yet had an opportunity of testing the grass in the cold climate of the district. He says: "I have been making inquiries with a view of getting at something reliable, and have spoken and written to the most likely men. I have not been able to come across nor hear of anyone who has tried some acres of it; but of those who are trying it on a small scale they are all hopeful of good results; all agree as to its drought-resisting properties and as food for stock and for hay, but they also agree the frost is a severe set-back, but does not annihilate it as it comes well again directly the frosts disappear. Some very fine specimens will be shown here at the forthcoming local show, and I will be able to introduce you to several who have tried it; in the meanwhile will try and gather further information."

Mr. John James, of Rose Valley, Gerringong, near Kiama, kindly supplied me with the following interesting and useful information:—"In reply to your inquiry about *Paspalum*, I am pleased to be able to report that this grass seems to do very well indeed in this district. Though late in the spring it comes on for summer feed when most of our artificial grasses are done, and makes wonderful autumn growth if only favoured with a few showers. I have had some of it now for about seven years and cannot claim that it grows in drought, but it keeps green and comes very quickly as soon as it gets any moisture. Stock are very fond of it and crop it very close wherever it is grown in the open paddocks where they have access to it. It does not make any growth in winter here. I think it should be a boon to farmers in this district if sown over the rough parts of the farms, hillsides, and should hold its own against ferns or weeds. I have just returned from Richmond River, and am of opinion that *Paspalum* has been a big factor in the progress of dairying there. I am now sowing 200 lb. of seed here."

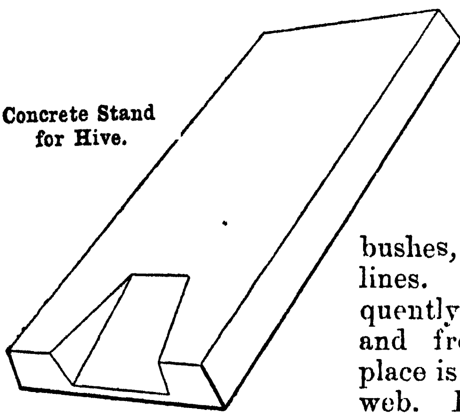
The Enemies of Bees.

ALBERT GALE.

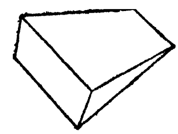
It is said that the species of insects number about five times as many as the species of all other living animals put together. By living animals I mean birds, beasts, fishes, &c., but not parasitical or microscopic animals. Every living thing has its enemy, or, rather, enemies. For many forms of parasites, &c., are found upon nearly every living creature—nay, I think I may leave the adverb out, and say every living creature. "Great fleas have little fleas upon their backs to bite 'em, and little fleas have lesser fleas, and so on *ad infinitum.*" We know that bees have fleas upon their backs to bite 'em, and I suppose these fleas have lesser fleas, and so on.

Let me take the arachnida (spiders) first. These are not insects, as is too often supposed. They differ from insects in many respects. Instead of being composed of head, thorax, and abdomen the spider has only head and abdomen. True, in some species of spiders the head is quite distinct, but more frequently the head is sunken into that part of the body that carries the organs of locomotion—the legs. Spiders are wingless. They do not go through such a complete metamorphosis as insects. The metamorphosis of the latter is ova, lava, pupa, and imago (egg, grub, chrysalis, and perfect insect), whilst the metamorphosis of the spider is bird-like, from the egg to the perfect form. Of course, they have their stages of infancy. There are some very curious forms among the arachnida and the araneina—other branches of the great family of spiders. I am going to deal only with those that are bee enemies, although I will not recommend you to make any variety of spiders special pets among your bees. No spider is a friend to insects. Give them a wide berth among your bees, as you would snakes, no matter venomous or non-venemous. Spiders are valuable as exterminators of noxious insects. I think the very worst of spiders to get among bees is that globular black fellow with a red band around his abdomen. They are very fond of lurking in the hand-holes of the hive. Their bite is said to be poisonous. A hive only partially filled with combs, or containing empty ones, have frequently one or more of these spiders concealed within a thick web. Wherever there is a hiding-place for spiders it is too frequently inhabited by one of these bee pests. If the hive stands on bricks, underneath the hive is a home for spiders; therefore the stand for hives should be solid (see *Agricultural Gazette*, November, 1902, page 1116, for a description of concrete stands for hives). Where the hip roofs or covers are used they should be so constructed that they can be easily freed from spiders and cobwebs. I have seen numbers

of the remains of bees underneath their nests, enough to fill a table-spoon; but then that was at or around the hives of a careless bee-man. The female of these red-banded spiders appears to be more voracious of slaughter among the bees than the male, especially so during the breeding season, when the white ball containing the eggs or newly-hatched young are under the immediate care of the dam. The male of this variety of spider is not so often seen as is the female; this, indeed, is the case with all true spiders. There is a reason for this, the details of which it is not necessary to give here. The most distinguishing mark between the sexes is the presence of a knob or club at the end of the forceps or mandibles. The only way of getting rid of this arch-bee enemy is to wage war against them wherever seen. Another spider that may be bracketed with the fore-going, although they do not lurk in the hive or around it, is the



Concrete Stand for Hive.



common garden spider. It constructs a geometrical web, generally stretched between two trees or bushes, and made taut by numerous stay-lines. They construct their net too frequently in the line of flight of the bees to and from their home. Their lurking-place is in a curled leaf in the centre of the web. I have seen the net of one variety of garden spider 2 feet in diameter. The nets are generally constructed in the evening, after the bees have retired to rest, and are ready for use in the early morning. The threads of these nets are very glutinous, coming as they do direct from the spinnerets (these appendages are attached to the abdomen), and woe-betide the unlucky bees when they sally forth in the early morning in quest of the first drop of nectar. They are caught in the meshes of the well-laid trap; they struggle, but struggle in vain. Some of these spiders are difficult to discover in the daytime, because sometimes their lair is away from the trap. Nevertheless, they are easily destroyed by going to their nets in the evening, just after sundown, when they will be seen repairing the damages done to their nests during the day. A sharp blow with a flat piece of wood is all that is needed.

The tarantula is one of the hunting spiders; it belongs to the genus *Lycosa*. They make no web; they capture their prey as a cat catches a mouse. The prey, when captured, is taken under some shelter and there devoured, and the remains left where the feast has been eaten. There is no need to give advice as to their destruction. They are the veritable Cains among spiders—every man's hand is against them.

The bee-louse (*Braula cæca*) is a wingless parasite found on the bodies of bees. It is reddish-brown. They are not much unlike a

small flea, being about $\frac{1}{16}$ in. long, and in shape much flatter, but instead of its body being flattened laterally the Braula are flattened vertically. In England they appear to have been introduced on imported bees, and "they rarely survive a winter in Britain," so says Cheshire. An American work on the study of insects says *Braula cæca* is found living parasitically on the honey bee in Europe, and has not been detected in this country (America). I have not seen it in Australia, but there is no reason that it should not be here. We have imported a large number of Italian queens from Europe, and we have not the winters here as in Britain to aid us in their destruction. Cheshire found them many hundred strong among some black bees, "and strangely, if only a very few exist in a colony, the queen carries them." When known to exist they are very easily removed. A small brush, the point of it just dipped in honey and lightly placed on the queen, will easily remove them from the queen's body.

Ants.—In all my experience I have never found any variety of these troublesome to bees. "The little black ant" is very fond of utilising the heat generated by bees for incubating purposes. You will find them on the top bar of the frames, and where the quilts have not been removed for some time I have seen these top bars well covered with both eggs and ants. Many of those bee-keepers when spoken to about the non-injury of bees by ants have, when ants have been thus suddenly exposed to view, given the usual amen to their belief by the stereotyped exclaim "I told you so." I have seen a frame of honey put on one side, and for a while forgotten, and when sought, it was well covered with these "little black ants," and this, too, was followed by the "I-told-you-so"; but wait awhile. In cases like the first I have brushed the ants and eggs pell-mell in amongst the bees. At once the bees commenced carrying out the unwilling intruders, and in a few minutes the ants and their eggs were sought for amongst the bees in vain. In the second case, I placed the ant-covered honeycomb between two frames of brood within the hive, the ants too were removed in like manner, only a little more rapidly.

I cannot shut my eyes to the fact that some one or two persons have brought forward eye-witness proof that contradicts my experience. These bee-keepers have asserted that these ants have not only found their way into the hive, but have driven the bees away, and taken full possession of their stores. Nevertheless, I cannot but think there were some conditions, either local or climatic, that have cowed down the usual protective trait of the bees.

Here is a recipe by Mr. Froggatt, the Departmental Entomologist, for the destruction of ants:—The most successful method of destroying the ants we have found without injury to the bees is with bisulphide of carbon. Hunt up the nest and pour about a dessert-spoonful of this fluid down each hole. Cover with a wet bag for about a minute, then pull it off, and apply a match on the end of a stick over each opening. The rising fumes igniting kills all the ants that escaped the fumes of the bisulphide by shattering the nests. No light or fire should be brought near the bisulphide until the nests are ready to be ignited. The bottle containing the bisulphide should be well corked

and kept in a cool place. This will do for the larger variety of ants, but I do not think it will do for the small varieties that nestle around the hives. These may be driven away by sprinkling or dusting the top bar of the frames and the edges of the hive, the interspace between the bottom board and the hive, also the interspaces elsewhere with snuff or pepper—the former is preferred; but it is as well not to be placed on the combs.

Among the insect enemies of bees, the bee moth, *Galleria cerella*, is so well known to bee-keepers, and its destruction so well understood, that were it not for amateurs it would be as well to pass it over altogether. In the summer evenings many varieties of the moth family are to be seen hovering around bees that are frequently mistaken for the bee moth. The male and female of these insects are very dissimilar, more especially in size. The male is fully two-thirds smaller than the female, and in colour much paler. Both male and female, in comparison to the size of their body, have large, broad wings; these are much indented on the outer edge; in colour dusky-grey inclined to be purple on the outer margin, and a few large brown spots on the inner. It is in the larval stages that this moth is most destructive. The webs, silken galleries, and white cocoon always impede the work of the bees, whilst the eating away of the capping of the honeycombs and the sealing of the brood cells are most destructive. They are the weeds of bee-keeping. No florist will permit weeds amongst his flowers, neither should a bee-keeper permit the signs of the bee-moth among his bees. In looking through your bees always look for signs. The prevention of the moth is strong colonies. Of course, my remarks never apply to the gin-case hive.

Bee-parasites.—In an old work, "The Grammar of Insects," I find the following:—"*Stylopidæ.*—Larva apod, with a corneous head; inhabits the bodies of bees in the perfect state, the head of the larva projecting between the abdominal segments of the bee. Pupa changes in the same situation. Imago, with elongate, linear mandibles and minute maxilla, but large maxillary feelers; the antennæ have but few joints, and these are very irregular in form. There are two tippet-like appendages near the head, and two large membraneous wings," &c., &c. The perfect insect flies in the sunshine, settling on twigs and leaves, and when under observation runs very rapidly. So far it has not proved to be of a very destructive nature.

Many insects and other such enemies were at one time more or less troublesome to bees under the old regime of beekeeping—the death's head sphinx, toads, snails, mice, &c.; but, thanks to Langstroth and other improvers of bee-keeping, these pests are things of the past.

There are certain birds that should have been included among bee enemies. They must be left for a future paper.

Imported Pigs for the Newington and Rookwood State Piggeries.

THE s.s. "Fifeshire," which arrived from London on the 27th January last, brought out, to the order of the New South Wales Government, six very fine pure-bred pigs, representative of the most improved types procurable in England.

These animals were consigned to the Director of Government Asylums (Mr. E. Hanson), and having complied with the Quarantine Regulations, are now stationed at the State Piggeries at Rookwood and Newington Asylums.

The purchasing commission was again placed in the hands of the well-known firm of Messrs. John Thornton and Company of Hanover Square, London, who sent out a lot of very fine animals to the same institutions some two years ago.

The large Yorkshire sires and dams sent out on that occasion have established themselves as some of the best of their type seen on this side. Three only appeared in the prize competitions at the Royal Agricultural Society's Show; one won the championship of Australasia, another first prize, while the third was placed second to the Champion sow. In Berkshires, Russell Swanwick's stock is not excelled in Australia. This successful selection on the part of Messrs. Thornton and Company, led to the placing of a further order for two Berkshire boars, two Berkshire sows, and a Tamworth boar and sow with the same firm. It is this handsome lot which came to hand per s.s. "Fifeshire." All these animals introduce fresh blood here, and, judging from the pedigrees of these pigs and the names of the breeders from whom they were purchased, Messrs. Thornton and Company appear to have succeeded in meeting their instructions to buy only the best type of blood stock obtainable in the Old Country.

Some of these animals have been registered by the Berkshire Society and the National Pig Breeders' Association of Great Britain, while those which have not have been certified to be eligible for registration

The pedigree certificates show that all these pigs have come from the cream of English stock, and several have successfully appeared in the English prize rings.

Taken right through, the "Fifeshire's" shipment may be claimed as one of the best importations made here, and when crossed with the blood stock stationed at the Newington and Rookwood Asylums, the herds at these institutions should prove an exceedingly profitable investment to the State.

We give below the pedigree and a description of each animal sent out in the "Fifeshire" :—

JOYCE,

Berkshire Sow; aged 11 months; bred by Arthur Hiscock jun., Esq., Manor Farm, Motcombe, England.

Sire: Harrison Robert (English Stud Book Registration No. 8,978).
Dam: Harrison Pansy (No. 9,610).

Harrison Robert was bred by Lord Carnarvon of Highclerc; and the dam, Harrison Pansy, is from the celebrated blood stock owned by T. Chick, Esq., of Dorchester.

This is a splendid animal, showing all the typical points of the improved Berkshire strain. It would be hard even for the most critical judges to find any fault with her construction. There is no doubt that this animal will be hard to beat in the show ring in the near future.

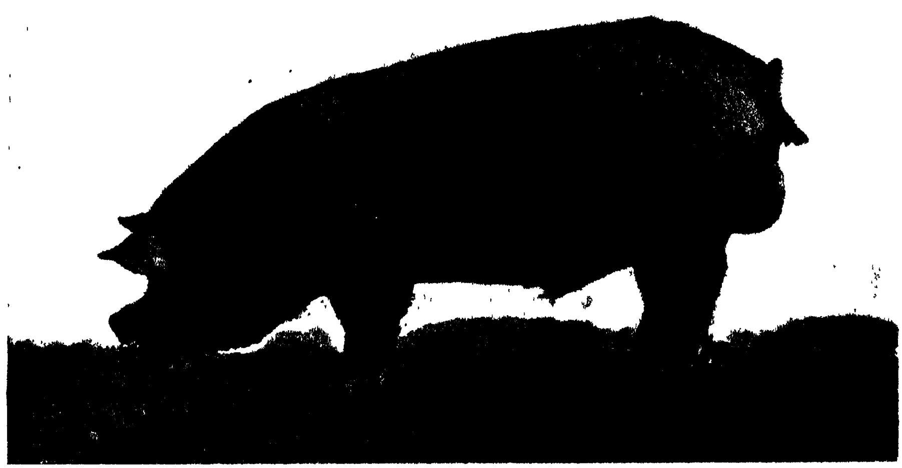
DANESFIELD LOTTIE III,

Berkshire Sow (Registered No., 10,151) aged 12 months; bred by R. W. Hudson, Esq., of Danesfield.

Sire: Danesfield Hampton (8,768), bred by R. W. Hudson, Esquire.
Dam: Buscot Lottie (8,585), bred by Sir A. Henderson, of Buscot.

Buscot Lottie was sired by the notoriously successful English prize winner, Royal Berks' (6,391). This valuable animal served in Mr. Russell Swanwick's stud, as well as in that of Sir Alexander Henderson, and other noted English breeders. Subsequently he was purchased by Mr. Vanderbilt for service on his stud farm in the United States.

Also a typical animal, with wonderful breadth and depth, and large hams, well let down. She has a very short, nicely dished head, and should be able to hold her own at the shows later on.



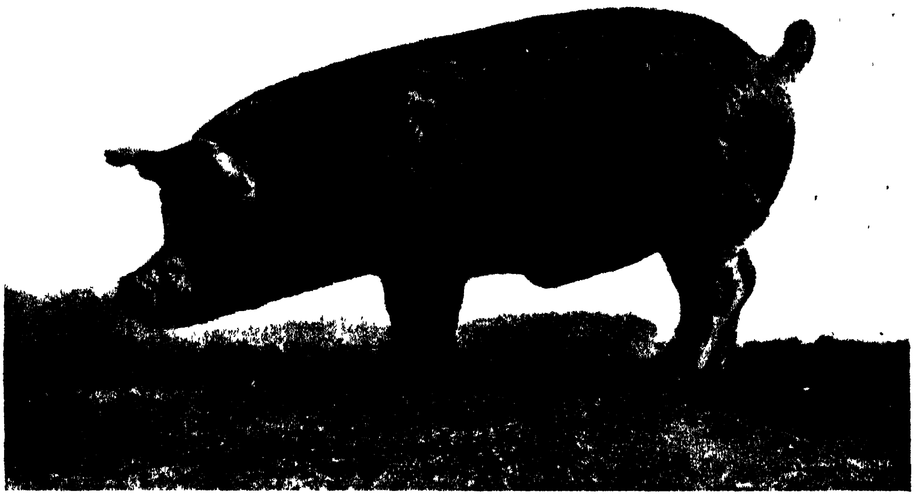
GOLD-DIGGER,

Berkshire Boar, aged 8 months; bred by N. Benjafield, Esq., Motcombe.

Sire: Goldfinder (No. 10,088); bred by Jos. Saunders, Esq., Sutton Cranborne, a successful English breeder of high-class stock.
Dam: Bichester Queen; bred by N. Benjafield, Esq., whose herd is well-known in the English show ring.

This animal is only nine months old, and has not yet got properly over his sea voyage. He is a boar of very fine quality, showing

superior breeding. He is descended from the champion Berkshire boar "Loyal Berks," who holds an unbeaten record in England, and is now the property of Mr. Vanderbilt, U.S.A.



OCEAN WAVE,

Berkshire Boar, aged 9 months; bred by T. A. Edney Hayter, Esq., of Hants.

Sire: Peter Maritzburg (No. 879); bred by C. Parons, Esq., of Hurstbourne.
Dam: Cradle (No. 8,476); bred by Earl Carnarvon, of Highclere.

Cradle's grand dam, Highclere XIV (5,043), bred by Earl Carnarvon, won the Champion prize at the Royal Show in England.

This is a very fine specimen of the improved type of Berkshire. Though only 10 months old, he promises well. He has a great side and ham, and a very short and concave head, such as is sought for by the breeders of the present day. He is very wide and deep, and an even pig throughout.

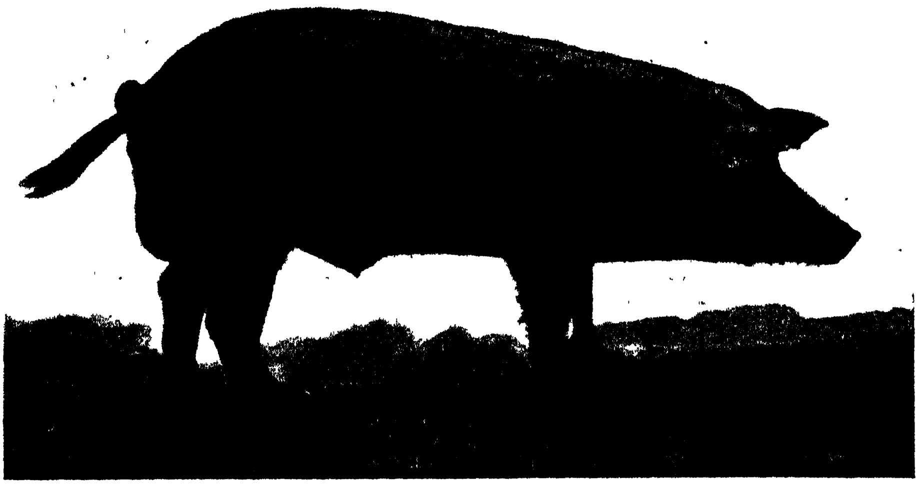
ROLLESTON COWSLIP III,

Tamworth Sow, Vol. XXI, National Pig-breeders' Association Stud Book; aged 13 months; bred by Sir Oswald Mosley.

Sire: Rolleston Roamer (7,505).
Dam: Rolleston Violet (15,396).

Rolleston Cowslip III was one of a pen winning second prize at Staffordshire Agricultural Show, Hanley, and she won first prize at the Derby Agricultural Show last year. Prior to leaving England she was served by Rolleston Cossack, the winner of the first prize at the Yorkshire Show, 1904.

This sow possesses the symmetry and rotundity of the Berkshire, with the exception of the head, which is, of course typical of the Tamworth breed. She is extraordinarily long and deep in the side, with very large hams, reaching down to the hock. She also occupied a place in the winning show-pens of the Cholderton herd. This is the type of animal that will probably remove all prejudice against the Tamworth pig for crossing purposes.



CHOLDERTON DON,

Tamworth Boar, Vol. XXI ; aged 13 months ; bred by H. C. Stephens, Esq., of Cholderton.

Sire : Cholderton de Cusack (7,435).
Dam : Cholderton Favourite II (12,056).

Cholderton Don brings into this State the blood of one of the most improved herds of the day in England.

This boar was in the second prize pen of boars at the Bath and West of England Show, and won second prize at the Royal Lancaster Show in 1904.

A tremendous animal, in fact he appears to be one of the largest pigs yet landed here. In spite of his enormous size, he displays evidence of improved breeding, and has a very deep side. The absence of the depth of side in the class of Tamworths now in this country has been the great objection of the farmers to this profitable breed of pigs. He comes from the Cholderton herd, which has been unbeaten in the English shows this year, and is himself a prize winner.

These animals are required to still further improve the high quality of the valuable blood stock at the Asylum Piggeries; and also to enable the authorities to more fully meet the increasing demand for high class stock coming in from the pig breeders throughout the State.

The arrival of this shipment is therefore of considerable importance to the farming community interested in this industry, compartively few of whom are in a position to improve their herds by incurring the heavy expense of direct importation; and as the stock from the limited number of imported beasts hitherto introduced here has been highly valued, the small farmers have not had the means to improve their strains by purchasing blood stock from the local avenues of sale. Inbreeding has followed, and the industry has severely suffered in consequence.

Confirming evidence of the fact that the farmers in this country have not been able to obtain possession of high-class stock will be found upon examining the published prize lists issued by the Royal

Agricultural Society of New South Wales. In past years the awards have been distributed amongst a very limited number of pig-breeders; competition on the part of the farmers has not been in any way representative and those who did compete were seldom successful.

In developing the excellent stud stock, and providing the septic tanks and up-to-date buildings at Newington and Rookwood, the authorities have had to contend with some of the many disadvantages experienced by the farming community.

All expenses came out of the profits derived from the sale of pigs, and improvements to buildings and additions to stock must stand over until the profits are sufficient to cover the cost. Blood stock of the class required was none too plentiful, even at the high prices demanded, and importing direct, some years ago, was out of the question, as the revenue coming in had to be spent on the styes, &c.

Having experienced these difficulties in developing the industry under his control, the Director of Asylums fully realised the serious disadvantages which surround the small farmer struggling to make pig-breeding pay in this country.

Immediately he found himself in a position to sell young stock profitably on easy terms, he brought the matter under the notice of the Chief Secretary; and Mr. Hogue not only directed that practice to be brought into operation, but he also instructed the Agent-General to have the "Fifeshire" consignment sent out to enable the strains on hand to be still further improved, and the farmers orders more fully met.

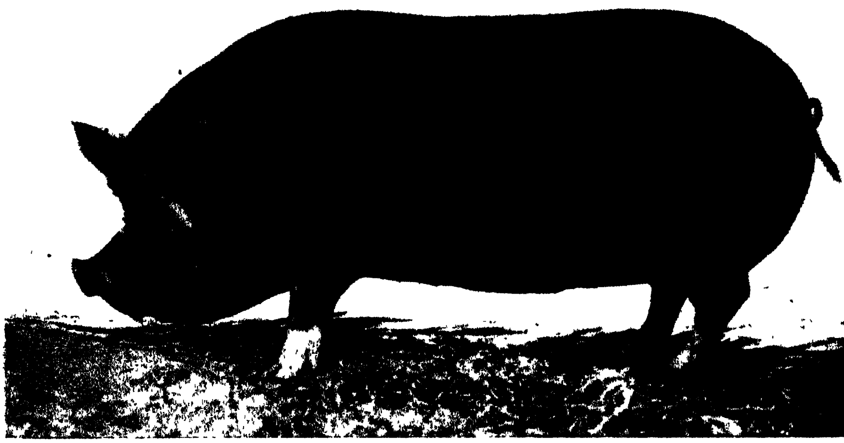
This business arrangement, which is not disadvantageous to the Government, has been very favourably received by the farmers throughout the State. Any pig breeder in New South Wales may now, for the reasonable sum of £3 3s., purchase young stock from any improved type that may take his fancy at the Rookwood and Newington piggeries, and a much wider selection can be made later on when young stock is available from the high-class animals now to hand.

With these facilities placed at the disposal of the farmers, Mr. Hogue is of opinion that the herds should show a marked improvement in a few years time—a development that will prove mutually advantageous to the farmers and the State; and as the pig breeders are now in a position to select from these piggeries, at a reasonable figure, young blood stock from any one of the many improved English strains owned by the Government, the competition in the prize rings should be keener, and they should be able to hold their own against all comers in open competition. And judging from the largely increasing number of farmers who visit these piggeries and effect purchases in high-class stock, there is substantial evidence of a spirited effort being made to place this industry on a better footing in New South Wales.

Mr. Hogue wishes it to be understood, also, that the pig-breeders here, in addition to being able to secure high-class animals at the institutions under his administration, have the opportunity as well of procuring excellent animals from the stud stock in the piggeries of the Department of Agriculture.

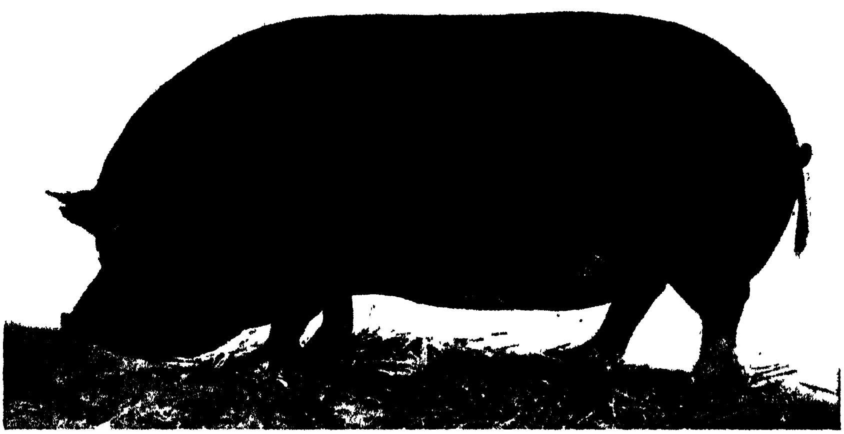
Two Fine Berkshires.

"Russell Swanwick," the fine Berkshire boar imported from England some time ago, and now stationed at Newington Asylum, is getting some excellent stock. We publish hereunder two plates, one of "Miss Swanwick," and one of "Sally Russell," two sisters sired by "Russell Swanwick" out of Newington "Rookie."



MISS SWANWICK.

Berkshire Sow, 14 months; Sire: Russell Swanwick (imported); Dam: Rookie (bred at Newington Asylum).



SALLY RUSSELL.

Berkshire Sow, 14 months; Sire: Russell Swanwick (imported); Dam: Rookie (bred at Newington Asylum).

These excellent specimens of Berkshire pigs are now in the stud pens at Newington. That there is a general demand for "Russell Swanwick" stock from buyers who understand the points of a pig can be readily understood when we look upon "Miss Swanwick's" picture, and upon that of her still more attractive sister "Sally."

Dairy Notes.

M. A. O'CALLAGHAN.

Dairy Shorthorn Cows at Grafton Farm.

Hindquarters of "Beauty."

THERE are some excellent specimens of the Illawarra Shorthorn at the State Experimental Farm, near Grafton.

Out of sixteen cows in milk, all on their first calf, three gave 5 gallons or over per day for some time after calving. The photographs here given represent some of the cattle.

The roan cow is by Favourite (imp.) from an Illawarra cow.

The red and white cow "Beauty" is a very heavy milker. The photograph giving the hindquarters and udder of this cow shows how evenly the udder is balanced, how well it comes back and fills out high up towards the root of the tail. The hindquarter is thin and flat, and its lines are typical of the heavy milker.

"Beauty."

Roan Cow.

Factory Notes.

Australian Butter.

Ex "Victoria."

All the butter sent by this boat has been adversely commented on, owing to its having been landed and evidently carried at a higher temperature than was desirable. It was a lucky circumstance for Australian shippers that England was pretty bare of butter at the time, also that there was an unusual demand for middle-class butter, or a very low price would have had to be accepted for a big proportion of this shipment. A good deal of the butter sent by this boat proved to be more or less fishy on arrival. This coincides exactly with the information published by the writer on this subject a couple of years ago. The organism that causes fishiness is present, more or less, in a great many butters; but if the temperature is kept below 20 deg. F. the organism cannot grow, and thus fishiness cannot develop *on the voyage*, though it may do so after the arrival of the butter in England.

Writing on February 10th, 1905, from London, the Commercial Agent for this State, Mr. C. C. Lance, stated:—

The *Victoria* shipment does not appear to have been in good condition, the butter being softer on arrival in Tooley-street than I remember to have seen it, and this is the general opinion in the trade. The general quality of the shipment is lower than on any previous

occasion since the new season commenced, many brands being fishy. A good many brands also show signs of having been heated prior to shipment.

Under the circumstances, I cannot do better than publish, in detail, Mr. Lance's reports on the shipments per s.s. *Victoria* and per s.s. *Omrah*. The *Omrah* arrived in London on January 30th and the *Victoria* on February 6th, 1905.

The numbers represent the same brand of butter in each case, and it will be seen, judging by the flavour, which, of course, would suffer most, the butters on the *Victoria* were generally inferior to those on the *Omrah*.

Butter ex *Omrah*. Arrived London 30th January, 1905. Examined at request of factories.

No.	Packing.	Flavour.	Make.	Colour.	Salting.	Condition.
1	Good	Sweet (but rather flat)	Poor texture; too open, too much moisture.	Correct..	Correct..	Good.
2	Good (but paper might be thicker)	Very good ..	Good texture ..	„ ...	„ .	„
3	Good ..	Very good (but slight irregularity in boxes)	„	„	„ ..	„
4	Not well finished; not rolled.	Fair .	Fair texture ..	„ ...	Rather too salt.	„
5	Good .	Good .	Good texture; rather much moisture.	„ ..	Correct..	„
	„ . ..	Very good ..	Good texture	„ ..	„	„
	„ ..	Good	„	„	„ .	„
8	Might be better finished.	Fair . .	Rather coarse in texture.	„	„ .	„
	Well got up; double paper an improvement	Good sound butter	Texture rather coarse.	Rather too high.	„	„
10	Good	Common and fishy	Fair texture, but rather moist.	Correct.	„	
11	„	Good .	Good texture	„ .	„	
	Good, but brand on butter not so clear as usual.	Very good .	„	„	„	
13*	Good, but stencilled brand unsightly.	Very good	„	„ ..	Appear to be slight quantity of salt.	
14	Good ..	Sweet, but rather flat	„	„	Correct..	
15	Not well finished.	Common and sour	Poor texture, too open, too much moisture.	„	„ ..	
16	Good	Good . ..	Good texture, but slightly mottled	„	„	
17	„ . ..	Common .	Poor texture, too open, too much moisture.	„	„	Slightly heated.
18*	„	Very good .	Good texture	„ .	„	Good.
19	Irregular; each of three boxes showed distinct methods.	Irregular; each of three boxes showed different qualities, one being inferior.	Good texture, but some boxes show too much moisture.	„	„	One box ou of three heated.
20	Good	Good . . .	Good texture			Good.
21	Not well finished .	Common and strong .	Fair texture, but too much moisture.	„ ..	„ ...	Badly heated.
	Good (but lettering on butter obliterated).	Good	Good texture			Good.

* Unsalted.

CHAS. C. LANCE,
Commercial Agent.

London, 3rd February, 1905.

Butter ex *Victoria*. Arrived London 6th February, 1905.

No.	Packing.	Flavour.	Make.	Colour.	Salting.	Condition.
	Good	Common	Good texture	Correct..	Correct..	Good.
		Good, but not up to recent standard.				
		Only fair, inclined to be fishy.	„	Rather high.	Rather too salt.	
	Should be better finished.	Common	Fair texture ...	Correct..	Correct..	
	Should be better finished; paper thin.	Fair	Good texture			
	Good, but paper too thin.	Good				
	Good	Common and fishy				
	„	Common	„			
	Double paper, but it is too common; a bad colour.	Fishy and common .	Fair texture			
10	Good	Common and strong	Fair texture, but too much moisture.			
		Fishy	Good texture ...	Rather too high.	Correct..	
	Good, but brand on butter not sharp and distinct.	Good	„ ..	Correct..	Correct..	
13'	Should be better finished.			Correct..	There appears to be slight salt.	
14	Good, but paper too thin.	Common	Fair texture	Correct..	Correct..	Heated.
15	Not well finished; not rolled; paper too thin.	Fishy	„ .	„ ...	„	Good.
	Good, but paper rather thin.	Good	Good texture .			
	Good ...	Common	Fair texture, but too much moisture.			
18*		Good	Good texture			
19		Common and irregular.	„ .		Correct..	Heated.
20		Good . .	„			Good.
21		Common	Fair texture			Heated
22	Good, but impression on butter obliterated.	Fair, rather common				

* Unsalted.

CHAS. C. LANCE,
Commercial Agent.

London, 10th February, 1905.

Factory Brands.

Evidence given before the Butter Commission in Melbourne went to show that some agents kept on hand a big stock of brands for variety purposes. If the "Golden Guinea," for instance, got into bad odour, it would disappear for the time being, and the "Golden Cup" would take its place quite naturally. On the other hand, if a brand got a very high name for its goods, a cable may come for, say, 3,000 boxes of that "Golden Churn" brand. The factory who made the brand's reputation can supply only 1,500 boxes; but the agent is not to be outdone, so he provides 1,500 empty boxes, gets them branded "Golden Churn," and despatches them to a few factories to fill. In due time they accompany the legitimate "Golden Churns," and if the quality is really prime no great harm may be done; but if they are

inferior, then the factory that spent years of skill and labour in making its reputation receives a big knock. Another method is to adopt an entirely new brand, make it the registered brand of your firm, if you are an agent; when it has worked up a reputation, get butter from the best factories, shave off their brand, and put on your own universal patent fitting substitute. This is all business; but the question arises,—Is it good business for the factory, and is it good business for the State?

At the present time there appear to be a number of brands of butter "made in Sydney." London records show this. Who makes the butter sailing under those brands? Echo answers, Who? Three brands should be enough for any factory. These should be registered, and no butter should be allowed to leave these shores that did not bear the registered brand of some real, not imaginary, butter factory. I have drawn the attention of our factories to this matter. Theirs is the duty to insist on their rights; my work is educational only. When I have shown the true position to the farmer, and recommended a method of reform, it is for others to take up the matter and push it to a conclusion.

Butter Factory Reports.

The Factory that ought not to exist.

During the years 1900 to 1905 there has been a tendency to convert old dilapidated separating-stations into central butter factories without making the necessary improvements to enable a butter-maker to turn out butter of a high class. Were there proper dairy laws, which would protect this fine industry from injurious influences, thus enabling it to develop on sound lines; these improperly equipped, improperly ventilated, and improperly constructed so-called central butter factories would never receive a licence to manufacture butter for export.

Looking through Mr. Lance's last report, I have been struck with the generally inferior quality of the butter which has found its way to the English markets from these unsuitable butter-making stations.

There are not a great many of these in the State, but, unfortunately, their number is on the increase. I give below copies of Mr. Lance's reports on the butter from these factories:—

Ex s.s. *Runic*.

Factory No. Report.

1.—Flavour, common; colour, too high; texture, fair; condition, heated.

2.—Flavour, common and fishy; condition, heated.

3.—Flavour, common; packing, fair; texture, fair; colour, too high; condition, heated.

4.—Badly finished; flavour, common; texture, fair; colour, too high; condition, heated.

5.—Flavour, common and sour; texture, poor—too open and too much moisture; not well finished.

6.—Flavour, rather tallowy; texture only fair and butter somewhat mottled.

7.—Packing, not well finished; flavour, very inferior, common, and strong; texture, fair; condition, heated.

Contrast these reports with those published on another page of butters sent by well-equipped factories.

The Factory that does Credit to the State.

Reports received from Mr. Lance regarding the quality of butter shipped by New South Wales factories.

These reports refer only to factories who have requested Mr. Lance to report.

The s.s. *Omrah.*

Bega Factory, Burrawang brand.—Flavour, very good; texture, good; colour and salting, correct; condition, good; packing, good.

West End Bemboka Factory, Fern brand.—Flavour, good; texture, good; colour and salting, correct; condition and packing, good.

Smithtown Factory.—Flavour, good; texture, good; colour and salting, correct; packing and condition, good.

Ballina Factory, Uralba brand.—Flavour, very good; texture, good; colour and salting, correct; packing and condition, good.

Ulmarra Factory, Calliope brand.—Flavour, very good; texture, good; colour and salting, correct; packing and condition, good.

Cootamundra Co-operative Factory, Australia brand.—Flavour, good; texture, good; colour and salting correct; packing and condition, good.

A factory of which there are generally good reports is the Lower Manning Co-operative, its Wingham brand of unsalted butter being always on top for quality. Various other New South Wales factories have got good reports from Mr. Lance, but as they have not accepted his offer for information, the results cannot be published.

Hawkesbury Agricultural College.

Monthly Weather Report.

Summary for March, 1905.

Air pressure.			Shade Temperature.				Air Moisture Saturation = 100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean	Lowest.	Highest.	Mean.	Mean for 13 years	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month	Monthly Mean for 7 years.	% of the year's Evaporation.
29·83 3rd.	30·38 19th.	30·11	50·2 30th.	96 4 10th.	69·938	69·39	53	99	76·5	0·234 30th.	4·333	4·635	10·355

Rainfall

March	1	2	3	5	8	11	12	16	21	22	23	25	26	27	28	Total,	Mean rainfal for 13 years,
Points	26	65	158	5	1	trace	trace	3	14	33	$5\frac{1}{2}$	3	9	22	10	3·547 in.	3·934 in.

	N	NE	E	SE	S	SW	W	NW
Wind ...	...	20	...	6	4	3	1	1

Thunderstorms on dates—1, 2, 8, 25, 27.

Greatest daily range of temperature, 40°—10th March.
Extremes of rainfall 1·018 in., 1902; 16·217 in., 1894.
Days on which shade temperature rose above 90° Fahr.—10th, 96·4.

Remarks.—An average month, with good rain during the first week, and two wet spells later—21st–23rd, and 26th–29th, during which we only received light falls, which were, however, very acceptable, as, in spite of the early falls, the soil had become very dry. Foggy mornings were frequent, indicative of autumn.

CHAS. T. MUSSON,
Observer.

Hawkesbury Agricultural College and Experimental Farm.

FARM NOTES.—MAY.

H. W. POTTS.

ALL the conditions best for farming operations this month exist in the most suitable form, and every opportunity should be taken to push on with cultivation and sowing to get in the main crop. The prospects of a good season are most favourable.

Large sowings of wheat may be made, and the varieties best suited for this district are Bobs', Nonpariel, Australian Talavera, and White Lammas.

The experience gained here points to the value of Macaroni Wheats as being heavy yielders of green fodder and hay, as well as grain. Their chief advantage lies in their power to resist rust. For green fodder they produce a full growth, varying from two to five tons to the acre, and when top dressed with superphosphate a second crop for grain may be taken off. Where the crop is intended for hay, it is best to sow thickly. The varieties which have given the best returns are Belotourka, Medeah, Nut-cut, Cretan, Algerian, and Farrer's Durum. In all cases the grain should be drilled in with 1½ cwt. per acre of a mixture of two parts bone dust to one part superphosphate. Prepare the land by ploughing twice, and harrow after each, harrow the second time followed by rolling immediately before using the drill. Harrow and roll again after drilling.

In all cases when arranging to sow cereals it is time and money well spent to have the seed graded. Plump, large, clean seed will produce healthier and more vigorous plants. They are better enabled to withstand attacks of rust, resist drought, and are more economical to harvest. The yield in both straw and grain is enhanced in weight, quantity, and quality.

Oats.—Continue sowing oats throughout the month. The varieties found most reliable in combating rust are the Algerian and Argentine. They provide excellent hay in early spring. Tartarian and Dun oats may also be sown for a similar purpose. In each case the fertilisers recommended for wheat should be applied with the drill. Manuring in this form could be dispensed with if sowing followed a leguminous crop.

Barley.—The value of barley in successive crops for green fodder in spring should not be overlooked, and the most suitable variety for this purpose is Cape. Skinless barley has also been grown successfully for green feed. May is the best month to sow English Chevalier and Carter's Prize Prolific for malting purposes. It is well to remember that barley requires a well-prepared and fine seed-bed after thorough

cultivation with a rich soil, and a readily dissolved manure on the surface. For green fodder, 2 bushels to the acre may be used broadcast.

Rye.—Continue the sowing of this grain during the month. Emerald and Thousandfold have the best reputation.

Turnips, Swedes, and Rape.—Small sowings may be continued.

Lucerne and Clover.—Where the soil is ready and fine during the early part of the month, the last sowings for the season of these useful fodders may be made.

Field Peas.—Suntop, Grey, Dun, or Blue peas should be sown. The former variety has established an excellent reputation in the Hawkesbury district.

Tares or Vetches.—The Golden and Black tares do well either sown as a full crop or in combination with oats or barley. Both as a green fodder or a green manure, this crop is especially valuable, more particularly in renovating impoverished soils.

Onions.—Should be largely sown after the soil has been thoroughly worked. The conditions exist now for quick germination and sturdy growth. James' Keeping, Brown Spanish, and Brown Globe are useful sorts.

ORCHARD NOTES.

W. J. ALLEN.

MAY.

At time of writing nearly the whole of the State has benefited by beautiful soaking showers, which have so penetrated the soil as to make the weeds, or any crops sown for green-manuring purposes, spring into growth. It is not advisable to do any more work than is absolutely necessary in the orchard for some time, but give it a complete rest so that it will loosen up, and any weeds which may grow can be turned under later on, before the seeds of same become ripe and blow about.

Working soil which is wet in the fall of the year tends to pack it and make it hard, so that it is as well to let it have as complete a rest as possible for the next month or two.

In citrus orchards there is a certain amount of work which must be looked after, such as picking up windfalls and pulling some of the riper fruit which it is intended to market. Also there is the ripe passion-fruit to handle in some of the vineyards, but wherever possible avoid going on the orchard while the ground is very wet.

Refills in deciduous orchards may be planted out this month, if the young trees are available. The earlier they are planted now the stronger they will start away in the spring.

During the past month Mr. Thomas Grunsell, of Goulburn, forwarded me samples of apples of three varieties, which he has grown

from seeds, and numbered 1, 2, and 3. No. 1 was a particularly good Fall apple, dessert, of good bright colour, medium size, and which he claims crops heavily with him. In my opinion it is well worth a place in any orchard. No. 2 seedling is a large dessert apple, well-coloured, of good flavour, and with nice crisp flesh, but as this is the first year the tree has borne any fruit, it is early to say whether or not it will prove a heavy and regular bearer. No. 3 specimen was not so well-coloured nor, in my opinion, was the flavour quite so good as the first two, but as the variety was one which would keep for a long time, it is quite possible that in the course of a month or two the flavour would have improved. No. 2 specimen would also, I imagine, prove a good keeper.

Mr. Grunsell is to be congratulated on his success in raising three such good seedlings.

I have to acknowledge also some very fine specimen cherries from Mr. G. P. B. Jackes, of Armidale, and Mr. J. S. Hicks, of Orange. I doubt whether any country could surpass the specimens submitted, and it only goes to prove that the cherries produced in this State are of the very highest quality.

The Intercolonial boats are landing about 20,000 cases of apples and pears in Sydney each trip from Tasmania. Why cannot our own growers supply at least our local demand? I am pleased to say that the Cleopatra apples at our Bathurst orchard are again very free from Bitter Pit this year, and we have again found that all trees which were well spread out and exposed to the sun and air had little, if any, fruit affected with this disease; while those trees which were more compact had occasional fruits affected. The trees were all well sprayed early in the season with Bordeaux mixture, and it seems to me that with proper treatment we will be able to grow this apple without the fear of losing many from this disease.

This is a good time to set strawberry plants wherever they have not yet been set. Owing to the bountiful supply of rain which fell during the month of April, it was a very favourable month for such planting.

We have received from Mr. Valder, the Commercial Agent in South Africa, some very fine samples of apples, pears, and plums, from the well-grown Rhodes orchard. The apples (Jonathan's) were, however, the only ones which arrived in good condition, and these had developed considerable Bitter Pit on the journey out. The Kelsey plums arrived in an over-ripe condition, while the pears were perfectly rotten; the varieties were Fertility and Bartlett.

In an earlier issue I advised that we were making experiments in the Italian method of preparing lemon and other peel. These have turned out to our satisfaction, and the peel has now been sold to Messrs. E. Rich & Co., and has brought from 4½d. to 5½d. per lb. In a later number of the *Gazette* will be found full particulars regarding the making of same by Mr. Hogg, who was in attendance during the whole of the time of the processing of same, for the purpose of taking notes.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of May.

Vegetables.

Rain generally falls satisfactorily during the month of April over the State, and this year, at time of writing, there has been splendid rain, with good prospects of a sufficiency for the growth of seasonable vegetables.

Broad beans and peas will be the most prominent of the legumes in cultivation, although in the sheltered warm localities about the North Coast, French or kidney beans may be grown successfully throughout the year. Tomatoes also, to some extent, may be grown, as well as potatoes and other tender vegetables, but it is almost useless to sow seeds of these wherever heavy frosts occur. Tomato plants may be kept alive—young rooted cuttings—in many localities with cool temperatures, under some kind of protection, for the purpose of planting out as soon in the spring as is advisable. Such rooted cuttings will grow quickly as the season advances and bear fruit sooner than seedlings raised in the spring. Plants of young capsicums can also be kept alive, under protection, for early fruiting next season. By a little management, in this way, the season for such kinds of plants may be extended to some extent. But wherever natural shelter has been destroyed, or where artificial shelter has not been provided for the garden, the difficulty of keeping tender plants alive will be increased.

Asparagus and Rhubarb.—As the same kind of work is necessary for these two permanent vegetables, they may be referred to in the same paragraph. Both of them may be planted towards the end of winter or early in the spring before they begin to shoot, but in order to grow them to the best advantage it is advisable to have the land prepared for them some time in advance of planting. Have the land well dug, or better still trenched, keeping the top soil on the surface, and, unless it is naturally in good heart, dig in and mix well with the soil a heavy dressing of good dung, the more the dung has been saturated with urine the better it will be. The undigested chaff which is not infrequently used for manure is of value only as vegetable matter. However, if some sulphate of ammonia or nitrate of soda, with superphosphate of lime and potash, be mixed up with this stuff, it will, when rotted, make a useful general manure for vegetables. To save the trouble of mixing the different ingredients mentioned, a "general fertilizer" can be obtained. I may say that I have found nitrate of soda applied to established plants of asparagus in the spring, either as a top dressing or dissolved in water, to be very useful indeed.

Broad Beans.—Seeds may be sown as extensively as may be required. One of the most useful varieties is the Windsor broad bean. There are many varieties, some with huge pods, but the above is a reliable good bean although an old one.

Beans, French or Kidney.—Sow only in warm localities where early frosts are not likely to occur.

Beets, red and silver.—Attend to growing plants. Keep down the weeds and thin out well in order to allow each plant to make proper growth. Do not sow any more seed during the month.

Borecole or Kale.—Sow a little seed if it be thought that more plants will be required. Cultivate the soil frequently between the rows of all kale which have been planted out.

Brussels Sprouts.—This most useful vegetable succeeds best in a cool climate, and should be grown wherever it is likely to be successful for it is one of the best of the cabbage family. A little seed may be sown to keep up a stock of seedlings. Any plants that are sufficiently advanced may be planted.

Cabbage.—A little seed may be sown to keep up a succession. Advanced pricked out seedlings can be planted out from time to time to meet requirements.

Cauliflower.—Sow a little seed and plant out advanced pricked out seedlings.

Carrot.—This is a good time for the sowing of carrot seed. Sow it thinly in drills in well-worked soil. Thin out the seedlings by degrees until the remaining plants stand well apart. Keep down all weeds by frequent cultivation between the rows and hand-picking amongst the young plants.

Celery and Celeriac.—Plant out strong plants from seed-bed. Earth up advanced plants.

Endive.—Sow a little seed and plant out strong seedlings that may have been raised.

Leek.—Seed may be sown in good quantity, in, say, two or three sowings during the month. It may be sown in a seed-bed, and the young onions transplanted when large enough to the permanent bed. Dig the soil well, drain well, and manure well, that is if the soil is not rich enough to grow onions without manure. Make the soil on surface of bed quite fine if the seed is to be sown where the onions are to grow. Sow the seed thick and broadcast if you desire to raise small onions, say for pickling, &c. If large ones are required, sow thinly in drills, and when the young onions come up and have grown to a few inches in height, thin them out well. Should there be any vacant spaces in the rows, some of the thinned-out onions can be planted in the gaps.

Lettuce.—Sow seed and transplant seedlings.

Parsley.—This necessary herb should be in every garden. A little seed may be sown if plants are required.

Parsnip.—Sow a little seed in drills. The ground should be dug deep for this vegetable if good roots are required.

Peas.—May be sown from time to time as required.

Radish.—Sow a little seed occasionally in well-prepared small beds. Use well-rotted dung, and endeavour to grow the plants as quickly as possible, and use them whilst they are young and tender.

Mustard and Cress.—Sow a little seed occasionally.

Sea Kale.—This is a vegetable but seldom grown, probably because it takes a little more trouble to manage than other vegetables. Its botanical name is *Crambe maritima.* It must not be confounded with the borecole or kale, which belongs to quite another family. The sea kale succeeds best in heavy soil, thoroughly well manured, and dug or trenched 2 feet deep. At the present time of year the sea kale plants are, or should be, ready for planting—that is, when they are bare of leaves. Plant so that the tops of the kales are just about 2 inches below the surface when they are covered up. The plants start growing in the spring, and they should be encouraged to grow as much as possible by applications of good liquid manure throughout the growing season. In the autumn the leaves will die away, and the plants will remain dormant during the winter. Early in spring, before the shoots start from the crowns of the plants, large "kale pots," or large flower pots, one for each plant, should be placed over the plants, and over the pots dead leaves or something of that kind should be heaped. This becomes a sort of hotbed, and the leaves begin to grow, and if the light is kept quite away from them, they are quite white, and as tender as possible. When large enough, the blanched leaves can be removed for use, leaving a few around the crowns for use of the plants after the pots are removed. When well grown and quite blanched, the leaves, when cooked, make a most delicious vegetable. Should the crowns of the plants, after they start into growth when the pots are removed, develop a good many shoots or buds, remove all but one, and let this grow. Next season treat the plants in the same manner as before. All this seems a deal of bother, and it is not easy to describe in writing; but in point of fact, the work is as simple as possible, and may be managed very well by anyone who likes to make a trial.

Spinach.—A little seed may be sown of this good vegetable, which is well worth the growing.

Shallots.—Plant out a few cloves in well-prepared soil, with fine surface. Just press the cloves down into the soil.

Herbs.—Sow some seed, in order to raise some of these useful plants, which are indispensable for the kitchen.

Flowers.

The garden should still be quite gay with numbers of different kinds of flowers, although the time approaches midwinter; and the flowers which are now to be seen are more bright and beautiful and are sweeter scented than the same kinds are during the warmer season of the year. Many varieties of roses, of bouvardias, and of many annuals and perennials are bearing abundantly. The camellias, too, are developing their flowers, which before long will be very conspicuous. Truly this is a wonderful country for flowers, which may be had for,

one may say, the asking, by anyone who will but take a little trouble. Many chrysanthemums are still flowering, but as the flowers fade away the flowering stems had better be removed by cutting down to the base. As the petals are somewhat persistent, the old flowers, when they are faded, are anything but ornamental.

In the coastal districts evergreens may still be planted, but in colder places this work should be postponed until early spring.

Plant out spring-flowering bulbs, if any good sound ones are still on hand, or can be procured. Plant out also a good number of seedling hardy annuals of as many varieties as possible, and these will make a fine show early in the spring, if they be looked after, and are not smothered by weeds, which is often the case, unfortunately.

Every cottage gardener seems to be fond of stocks, pinks, and wallflowers. All sorts of these (except the ten-weeks kinds of stocks, which should be kept back until early spring) may be planted. In the limited space set apart for these gardening directions it is impossible to do justice to the flowers, or to give more than a few of the barest hints, which may, however, be of some use to those interested.

Crop Returns.

It is the intention of Mr. Hall, Acting Statistician, to send out with the *Gazette* for next month forms for the collection of returns relating to the average yield per acre of the maize, potato, table grape, summer fruit, and wine crops for the season just closed.

The Acting Statistician desires to acknowledge his indebtedness to our numerous readers who sent in reports *re* the recent wheat estimate. On those returns, coupled with particulars supplied by the local police, a remarkably correct forecast of the actual harvest was made. This fact is very gratifying, and the result shows that the work done by the reporters was not in vain. Mr. Hall is well aware, from the carefully-prepared and accurate returns furnished in the past, that those who render assistance in this direction, go to a considerable amount of trouble to collect the particulars, and he has requested that this notice be given in time to enable recipients of the *Gazette* who are kind enough to co-operate to have a good look round before the form comes to hand.

Mr. Hall remarks that only a limited number of forms will be issued, so that if you do not receive one with your *Gazette*, and are desirous of assisting, a communication addressed to "The Statistician, Sydney," giving particulars regarding the area under any of the abovementioned crops, and the average yield per acre, will be gladly received. These particulars are required to supplement the returns collected annually by the police.

Crown Lands of New South Wales.

THE following areas will be available for selection on and after the dates mentioned :—

H.S. or S.L. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
					For Homestead Selection.			
			a. r. p.		a. r. p.		£ s. d.	1905.
968	Dubbo ..	....	....	1	380 0 0	Murrumbidgerie, 1½	9 10 0	15 June
967	Narrandera.	....	316 3 0	2	153 2 0 and 163 1 0	Waddi (adjoining); Darlington Point, 3; Darlington Point Railway Station, 11; Narrandera, 39.	2 17 8 and 3 1 4	11 May
*966	Picton ..	....	1,477 0 39	65	10 1 20 to 49 0 0	Campbelltown, 3 to 5; Leumeah, 2 to 4.	0 3 1 to 1 4 6	27 April
965	Singleton ..	....	180 0 0	2	89 1 0 and 90 3 0	Singleton, 2 to 3.	1 13 6 and 1 14 2	25 May

* Available for "originals" only.

For Settlement Lease.

H.S. or S.L. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
791	Condobolin	South Condoublin and Kookaburragong.	6,993 1 0	2	3,579 1 0 and 3,414 0 0	Condobolin, 17 and 18	67 2 4 and 71 2 6	4 May
*790	Coonabarabran.	Ulimambri..	9,600 0 0	2	4,350 0 0 and 5,250 0 0	Coonabarabran, 14 to 17; Gunnedah, 60 to 61.	86 2 0 and 98 8 10	4 ,,
793	Coonamble	....	3,035 0 0	2	1,280 0 0 and 1,755 0 0	Gilgandra, 11; Dubbo, 51.	10 13 4 and 21 18 10	22 June
792	Narrabri ..	Bugilbone and Burren	33,250 1 30	6	5,148 2 0 to 5,942 2 0	Burren Junction, 5 to 14; Narrabri, 64 to 65.	96 10 10 to 111 8 6	25 May

* Available for "originals" only.

For Improvement Lease.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
					Central Division.			
			a. r. p.		a. r. p.		£ s. d.	1905.
1336 and 1337	Condobolin	Bygaloree..	8,160 0 0	2	4,060 0 0 and 4,100 0 0	Condobolin, 37 to 40.	39 9 5 and 39 17 3	Sale, 16 May
1339	Coonamble	Youlbung..	....	1	2,665 0 0	Tooraweenah, 2 or 3; Gilgandra, 20.	22 4 2	,, 15 ,,

For Conditional Purchase.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		a. r. p.			£ s. d.	1905.
Barmedman	Mimosa West	820 0 0	Windeyer	Bourke	0 10 0	15 June.
,,		1,475 0 0	Ariah	,,	1 0 0	15 ,,
Bathurst		555 0 0	Swatchfield	Westmoreland.	0 10 0	27 April.
,,		72 0 0	,,	,,	0 15 0	27 ,,
,,		2,210 0 0	Adderley	,,	0 11 8	27 ,,
,,		1,812 0 0	Crudine	Roxburgh	0 10 0	11 May.
,,		2,900 0 0	Vulcan	Westmoreland	0 13 4	8 June.
Bellingen		58 0 0	Bligh	Fitzroy	1 15 0	25 ,,
,, *		700 0 0	Moonee	,,	1 0 0	22 ,,
,, *		350 0 0	Ketelghay and Yarranbilla.	Raleigh	1 0 0	22 ,,
Casino*		520 0 0	Hogarth	Richmond	1 0 0	15 ,,
Cassillis*		713 0 0	Killoe	Brisbane	1 10 0	15 ,,
Condobolin	South Condoublin	87 1 0	Kookaburragong	Gipps	1 5 0	4 May.
Cootamundry	Combaning	844 1 0	Gundibindgal	Bland	0 10 0	25 ,,
,,	Temora	270 0 0	Temora	,,	1 5 0	15 June.
Deniliquin	Cornalla	50 0 0	Derrulaman	Townsend	1 17 6	11 May.
Dubbo	Bolaro (partly)	815 0 0	Bolaro	Lincoln	1 10 0	15 June.
Goulburn		225 0 0	Tyrl Tyrl	Georgiana	1 0 0	25 May.
Grenfell		75 0 0	Wheoga	Gipps & Bland	0 16 8	8 June.
Grafton	Newbold Grange & Cangai.	41 0 0	Kaloe	Gresham	1 0 0	15 ,,
,, *		2,160 0 0	Woogoolga	Fitzroy	1 0 0	22 ,,
Gundagai	Mount Adra	200 0 0	Ellerslie	Wynyard	0 10 0	8 ,,
Gunnedah		3,030 0 0	Melville	Pottinger	1 6 8	25 May.
Hillston	Uabba	960 0 0	Bunbalingal	Dowling	0 10 0	11 ,,
Inverell		56 2 0	Mackenzie	Hardinge and Clarke.	1 1 8	25 ,,
Moruya		46 0 0	Bateman	St. Vincent	1 0 0	22 June.
Mudgee		607 0 0	Cumbo	Phillip	1 5 0	8 ,,
,,		1,050 0 0	Werowera	Wellington	0 15 0	11 May.
Murwillumbah*		115 0 0	Brunswick	Rous	2 10 0	25 ,,
Narrabri		530 0 0	Gurleigh and Molle	White	1 0 0	25 ,,
,,		1,370 0 0	,, ,,	,,	1 10 0	25 ,,
,,	Glen Quin	4,180 0 0	Turrawan & Milner	,,	1 0 0	1 June.
,,	Dobikin	1,840 0 0	Gehan and Manamoi	Jamison	1 6 8	1 ,,
,,	Malaraway & Millie North.	290 0 0	Gehan	,,	1 10 0	1 ,,
,,		460 0 0	Wee Waa	White	1 10 0	15 ,,
,,		110 0 0	,,	,,	2 0 0	15 ,,
,,	Bugilbone	18,838 3 0	Khatambone, Bucklebone, &c.	Denham	1 10 0	25 May.
Rylstone		141 2 0	Goongal	Roxburgh	1 0 0	25 ,,
,,		315 0 0	Clandulla	,,	1 0 0	1 June.
,,		600 0 0	Bandamora and Coco	,,	0 15 0	8 ,,
Scone		127 0 0	Cherson	Brisbane	1 3 4	15 ,,
Tenterfield	Bolivia	165 0 0	Bolivia	Clive	1 0 0	8 ,,
Urana		645 0 0	Clear Hill	Urana	1 5 0	15 ,,
Wyalong*	Billabong and West Bland Plains (partly).	2,917 0 0	Bimbella and Back Creek.	Bland	1 5 0	4 May.
,,		6,585 0 0	,, ,,	,,	1 2 6	4 ,,

* Available for "originals" only.

Conditional Purchase as Special Area.

Carcoar Land District, 132 acres, in parish Carrawa, county Georgiana; maximum area, 132 acres; minimum area, 40 acres 3 roods; price, £1 10s. per acre. Available 15th June, 1905.

Lithgow Land District, 30 acres 2 roods 26 perches, in parish Thornshope, county Roxburgh; maximum area, 9 acres 3 roods 15 perches; minimum area, 3 acres 3 roods 29 perches; price, £4 per acre. Available 18th May, 1905.

Mudgee Land District, 64 acres, in parish Gulgong, county Phillip; maximum and minimum area, 64 acres; price, £1 10s. per acre. Available 15th June, 1905.

Murwillumbah Land District, 70½ acres, in parish Cudgen, county Rous; maximum area, 70½ acres; minimum area, 40 acres; price, £3 per acre. Available 1st June, 1905.

Narrabri Land District, in parish of Wee Waa, county of White; 81 acres 0 roods 30 perches, in three blocks; maximum area, 43 acres; minimum area, 15 acres 0 roods 10 perches; within the suburban boundaries of the town of Wee Waa; price, £2 and £2 10s. per acre. Available 25th May, 1905.

(Signed) EDWARD MACFARLANE,

Under Secretary for Lands

AGRICULTURAL SOCIETIES' SHOWS.

1905.

Society.	Secretary.	Date
Namoi P., A., and H. Show (Narrabri)	J. McCutcheon ...	May 2, 3, 4
Dungog A. and H. Association	Chas. E. Grant ...	,, 3, 4
Moree P. and A. Society	S. L. Cohen ...	,, 10, 11
Hawkesbury District (Richmond) A. Association ...	C. S. Guest ...	,, 11, 12, 13
Walgett P. and A. Association	Thos. Clarke ...	,, 17, 18
Nyngan and District P. and A. Association ...	Richard E. Burns..	,, 17, 18
Molong P. and A. Association	C. J. V. Leatham	,, 24
Hay P. and A. Association (Hay)	G. S. Camden ...	July 27, 28
Riverina P. and A. Society (Jerilderie)	Wm. Elliott ...	,, 25, 26
Corowa P., A., and H. Association	F. L. Archer ..	Aug. 15, 16
Parkes P., A., and H. Association	G. W. Seaborne ...	,, 16, 17
Murrumbidgee P. and A. Association (Wagga Wagga)	A. F. D. White ...	,, 23, 24
Forbes P., A., and H. Association	N. A. Read ...	,, 9, 10
Gunnedah P., A., and H. Association...	J. H. King ...	,, 22, 23, 24
Grenfell P., A., and H. Association	Geo. Cousins ..	,, 24, 25
Albury Annual Show	Walter J. Johnson	Sept. 12, 13, 14
Wyalong District P., A., H., and I. Association .	S. G. Isaacs ...	,, 5, 6
Northern Agricultural Association (Singleton) ...	C. Poppenhagen .	,, 13, 14, 15
Corowa P., A., and H. Association	F. P. Fawcett ...	,, 20, 21
Germanton P., A., and H. Society	Jas. S. Stewart ...	,, 20, 21

1906.

Albion Park A., H., and I. Society	Henry Tryer ...	Jan. 17, 18
Tamworth Agricultural Association	J. R. Wood ...	Mar. 27, 28, 29

[3 plates.]

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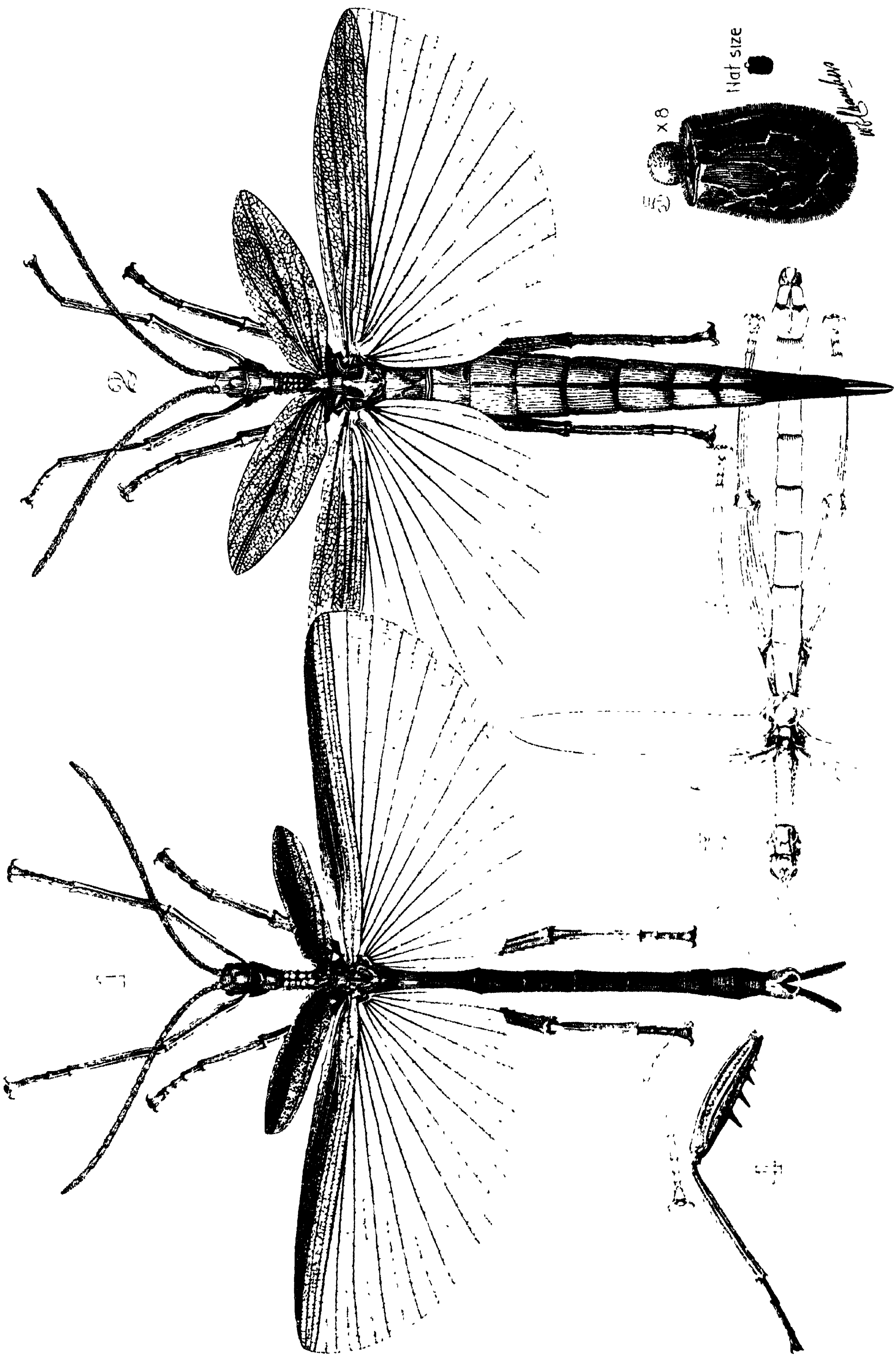


STICK INSECTS

1. *Podacanthus wilkinsoni* (*Male*)
2. ,, ,, (*Female*)
3. *Podacanthus wilkinsoni* (*Immature Male*)
4. ,, ,, (*Hind Leg Immature Male*)
5. *Podacanthus wilkinsoni* (*Egg*).

VOL. XVI. PART 6. JUNE 2, 1905.

Agricultural Gazette of New South Wales.

Stick or Leaf Insects.

NOTES ON STICK OR LEAF INSECTS, WITH AN ACCOUNT OF *Podacanthus wilkinsoni*, AS A FOREST PEST, AND THE SPINY LEAF INSECT, *Extatosoma tiaratum*, IN THE ORCHARD.

WALTER W. FROGGATT, F L.S.,
Government Entomologist.

THE large size and grotesque form of the orthopterous insects belonging to the Family Phasmidæ, better known under the popular name of Stick or Leaf insects, has always brought them under the observation of entomological collectors, and though very little is known about the early stages of the development of our commonest species, many of our larger ones were described at a very early date, chiefly by G. R. Grey, Westwood, and Macleay. Isolated descriptions of single specimens are apt to be misleading, as the difference in the sexes in some species is so marked that it has led to them being frequently described as distinct forms. In some groups both sexes are wingless, in others while the females are wingless the males are furnished with large flying wings, and are much smaller and slender in form.

They are amongst the most helpless of insects, and from their large size are destroyed by many birds, but, in compensation for their helplessness, nature has endowed them with most remarkable powers of imitative mimicry to the foliage among which they live and feed. Not only do their colours harmonise, but their wings, legs, and head are often covered with leaf-like spots and markings, the margins scalloped and crenulated in imitation of their food plants, so that in spite of its large size, if the insect remains motionless, it will easily escape detection right under one's eyes. They have a general appearance to the carnivorous Mantis, which, however, puts on its mimic livery to more easily capture its prey, but they can be distinguished at a glance by the difference in the structure of the fore legs which are used for walking, and are without claws or spines. They lay their eggs singly, dropping them on to the ground below, while crawling among the foliage. The eggs are rounded, enclosed in a very hard shell, and many of them are wonderfully like seeds. They often remain for upwards of two years on the ground before the larva makes its way out, a helpless stick-like creature, with slender body and legs, and though no parasitic enemy could get at them in the egg state, such helpless creatures as these baby phasmids must have an immense number of enemies in the first few weeks of their childhood. Australia is rich in large and remarkable looking species of phasmidæ, about fifty-four having been described, while probably in the interior many others

are still to be discovered, for although the casual entomologist often finds them from their awkward bulk they become damaged or destroyed in transit, and are difficult things to keep in perfect condition when collected.

The Ringbarker (Podacanthus wilkinsoni, *Macl.*).

This stick insect was described by Macleay in the Proceedings of the Linnean Society of New South Wales in 1889, from specimens obtained by the late Government Geologist, Mr. C. S. Wilkinson, near Binda Caves, who stated that they were so numerous at that date that large tracts of forest trees were completely stripped of their foliage, and appeared to be dying from their attacks. Macleay in commenting upon these notes said that it was probable that in many cases where the trees were found to be dying out, from no apparent cause, that it might frequently be brought about by the infestation of this or other allied species of plant-eating phasmids.

Bushes denuded of foliage by *Podacanthus wilkinsoni.*

In 1891, Olliff, in the pages of this *Gazette*, published a note on this insect: they were recorded as very numerous at Murphy's Creek, near Walcha, and since then they have been recorded as appearing in similar swarms every alternate year, which points to the fact that it takes two years from the time the eggs are dropped on the ground until the perfect development of the phasma

Through the kindness of Mr. J. F. Campbell, the District Surveyor at Walcha, with whom I have been in communication for a few years on this interesting subject, I was enabled this season, 1905, to visit the district infested by this gregarious stick insect, collect specimens, and make notes on the damage caused by their presence.

The country over which they range is about 50 miles long, comprising a wide strip of forest, including what is known as Murphy's Scrub, through Upper Tia, and Noundoc Station to the Gulf, a depression in the mountains towards the Manning River, in which district they are known as the "Ringbarkers," "Murphy's Ringbarkers," or "Lowrie's Flying Gang," on account of the dying brown appearance of the trees covering the ranges after they have been feeding through them. So like the effects of ring-barking upon the trees is this damage, that I was told that many years ago the forester, new to

the district, noting the brown foliage, accused the squatter of ring-barking timber on leasehold land without permission. At the present time (February), the adult insects are hanging in couples, or clambering over the tops of the young gum scrub, which are completely stripped of every leaf right down to the ground in many instances, while the tops of the large gum trees above are quite leafless, and many of them covered with dead branches that have died back for several feet from the effects of former attacks.

All species of eucalypts are devoured, but no other scrub trees are molested.

The young insects emerge from the eggs upon the ground in the early summer, but are not noticeable until they take on a yellow and black banded tint; growing rapidly, the bulk of them are full-grown about New Year, and commence laying their eggs towards the middle of February, and continue into March, when those that survive die with the first frosts which may come early in April in this district. Therefore, the eggs now being laid will remain dormant until the early summer of 1906, and the next crop of phasmids will be at New Year, 1907.

The adult male measures 3½ inches from the front of the head to the tip of the abdomen, with the slender antennæ in front about an inch longer, and across the expanded wings 4 inches. The general colour is dull green with brownish tints on the legs, the tegmina or forewings leaf-like, and edged with white on the outer edge, the hind wings with the front stripe opaque green, the base orange red, all the semitransparent portion pink with a shade of purple.

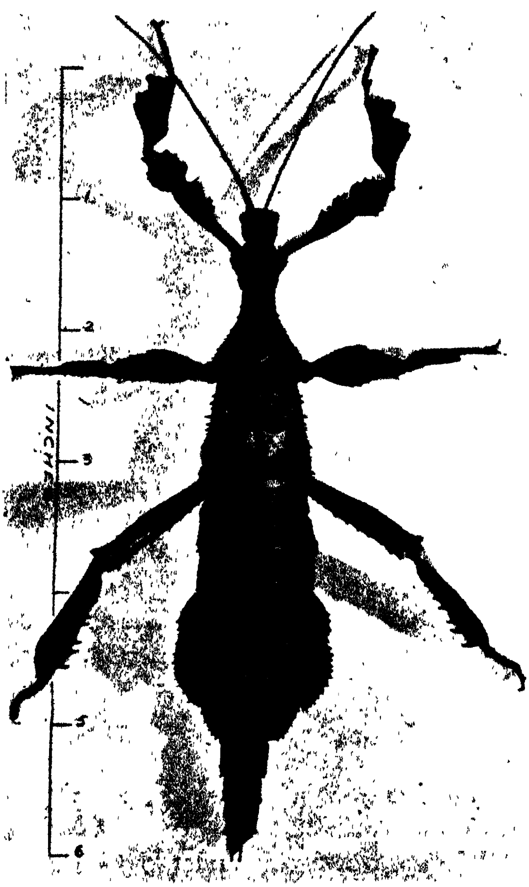
The head is rounded, the mesothorax forming a rounded neck covered on the upper surface with a number of conical spines; the legs and abdomen long and slender, the latter furnished with a clasping apparatus above the genitalia, and slender cerci at the extreme tip of the abdomen.

In several immature males collected at the same time, the mesothorax is fully twice the length of the adult, without any dorsal spines; the tegmina and wings small and rounded at the tips; the thighs of the hind leg stout and cylindrical, with two large black spines in the centre of the under surface not present in the perfect insect, and the male genitalia and claspers are undeveloped, simply represented by a swelling at the apex of the abdomen.

The female is of a very similar structure in the head, legs, and thorax, but of a lighter green tint, though it is very variable. The tegmina is light green, with the front margin of the hind wings of a similar tint, except the basal portion, which is a rich reddish orange tint, the membranous portion a deep purplish pink, somewhat brighter than that in the male wings. The abdomen is swollen, but tapering to the tip, is of the same green tint as the tegmina, with pinkish markings between the wings; the under surface of the abdomen roughened and almost black. On account of her thickened abdomen she looks shorter than the slender male, but the measurements both in length and across the wings are about the same. There is a variety often noticed among the females which have the whole of the tegmina, front of the wings, and abdomen reddish salmon colour.

The eggs are over one-sixth of an inch long, rounded behind, truncate at the summit, with a round plug projecting from the centre like the stopper of

a bottle. They are black in colour, with delicate fringes of plush-like material forming wavy lines all over the outer surface. Their numbers can be estimated by the fact that on one hillside in an area of about ¼ of an acre I collected about 500 specimens of these insects, which simply covered the low scrub; when handled the females eject a drop of fluid from the mouth, which has a sickly offensive smell, which may have some protective influence in regard to their enemies among the birds, for though the birds were plentiful, I did not notice any species feeding upon them, though I was informed by residents that the magpies, crows, and laughing jackasses do somtimes eat them. I was told too that in the ring-barking season, when the fowls eat them, the yolks of the eggs get a curious colour and are considered uneatable, just as in the western plains in the locust season, the fowls that eat them lay discoloured eggs.



Extatosoma tiaratum.

One squatter, whose young pigs died from the indigestion caused by the chitinous wings and legs, had the run of a paddock where the insects were plentiful on some low gum scrub where they could reach them.

The forest country, tenanted by this phasmid army at present, contains little timber of special value, but though they have been confined to this strip of country for so many years without spreading to other districts, altered conditions might cause them at any time to spread.

The clearing of tracts of country in their haunts has now broken up the once united swarm into several minor armies, and when once they can rise from the ground they can fly very well, and their wings (before the females become distended with eggs) are capable of carrying them considerable distances with a favourable wind. In good forest country they would cause immense damage, for the trees, denuded of their foliage, shoot out from the butts, often forming quite a thick scrub, and the wood does not split freely where it is being constantly damaged. In such a way the phasmid could develop into one of the worst forest pests in Australia, and be one very difficult to deal with.

In conclusion, my thanks are due to Mr. S. Watts, of Upper Tia Station, and Mr. Albert Lowrie for their kindness in showing me over the infested country, and furnishing information as to the phasmid's range and habits.

The Spiny Leaf Insect (Extatosoma tiaratum, *Macleay, W. S.*).

This species was originally described by W. S. Macleay in the appendix of King's Survey, published in 1827, under the name of Phasma tiaratum, but as the insects collected during King's voyages came from all parts of the Australian coast, there was no exact locality given. In 1833 G. R. Grey, published "The Entomology of Australia, Part I; Monograph of the Genus Phasmidæ," illustrated with fine coloured plates of all the then known species; in it he figured and described both sexes of this insect, calling the male "Hope's dilated-bodied Spectre," a rather cumbersome name (Extatosoma hopei), though he seems to have thought it might be the male of Macleay's species from the similar form of the head and legs. It is furnished with well-developed wings, their front margin green, and the network blackish, interrupted with whitish bands circling round, and its body is long and slender. In describing our species, which he called "Macleay's dilated-bodied Spectre," Grey says that his specimen was armed at the tip of the abdomen with a strong sharp curved black claw, which must have been some malformation, as the genitalia is very pronounced in this species. In conclusion, Grey says that "Mr. Cunningham has kindly informed me that they live on the saplings in the neighbourhood of Parramatta."

Extatosoma tiaratum **on Japanese Holly, showing imitative mimicry.**

The female measures up to 5 inches in length from the front of the head to the tip of the abdomen; general colour dark green with the upper surface clouded with a smutty tint, like that upon the foliage caused by black fumagine, while the sides of the segments are mottled with

white and brown imitating the shades of the moss and lichens found on the tree-trunks. The head is small, with a curious crown on summit, the thorax and abdomen swollen out into a rounded body edged with spiny flaps, the elytra represented by small bracts, wings wanting, and the legs dilated and scalloped like holly leaves. Three specimens were captured by an orchardist, Mr. Flusburgs, of Brunswick River, who found them in the foliage of his peach trees, into which they had probably wandered out of the surrounding scrub. When unpacked they were placed on a pot plant in the office window, where they hung in all manner of curious attitudes, sometimes holding on with only a single claw, at other times with two, but a favourite attitude was with the head thrown back and holding on with all the feet. They would remain motionless like this, except when carefully changing their position. On the journey down they laid a number of eggs, and here they continued egg-laying, a single egg falling at intervals on to the paper beneath the jar. The eggs are about the size of a large radish seed, somewhat oval in form, flattened on the sides, light brown in colour, with a creamy, glazed mark round one side, and a cork-like plug on the summit. They lived in this manner for eight days, then their legs began to relax, and they kept falling to the ground and died, evidently before their time, because when opened large numbers of eggs were found in their ovaries. Examination of a number of specimens shows that each phasmid lays about 100 eggs. This phasma has a very wide range, being recorded from Tasmania, the east coast of Victoria, along the tropical scrubs of New South Wales, Queensland, and New Guinea. In nearly all cases where I have collected this insect I have only come across single females, and never seen the male in its native state. The capture by Mr. Flusburg of three specimens of this phasmid is a unique experience.

Milking on Time.

It seems very hard on some farms to do things on time. One morning very early rising is the rule, and on another, generally Sunday, the reverse is the order. The dairyman who follows that rule never makes much money. Regularity in every department of the farm counts for a great deal, but it is a question if it counts for as much anywhere as it does in the dairy, in regard to the time of milking. If you have a young cow that gives promise of becoming a large milk producer, milk her at seven o'clock five mornings of the week and at nine on the other two. If you do you will very shortly make a cow boarder out of a milk producer. In the large dairy, it is, of course, more important to milk on time, and where there is a lot of one thing to be done, it is generally easier to adopt a regular system of doing it. It is, nevertheless, attention to the little things that counts in every department of business, and on the average farm where only a few cows are kept, they ought to be milked as nearly as possible on time, if they are going to pay a profit at the end of the year. —*The Farmer's Advocate.*

The Apple.

W. J. ALLEN.

To the man who devotes the whole of his energies to the production of fruit, and to the farmer who desires to have a plantation of fruit trees which can be depended upon to return a good profit for all the labour he can bestow upon them as a subsidiary line, there are certain varieties of the apple worthy of consideration.

Throughout the table-lands, in certain sections of the coastal districts, and nearly everywhere on the western slopes, there are to be found soils and situations favourable to the perfect growth of apples, for which there is not only great local demand but excellent opportunities in the export trade.

In Tasmania the apple industry stands relatively in the same position as wool-growing does in New South Wales. Not only does the Tasmanian apple-grower compete in a large way against all other countries in the British markets, but almost commands the apple trade of the capitals of the States of the whole Commonwealth. The Victorian and South Australian apple-growers also have during the last few years been able to secure a footing in the British markets. It can be safely said that in none of the three States mentioned are the conditions of soil or climate in any way more favourable for the production of high quality, long keeping, and good carrying apples than numerous districts of New South Wales.

The Department of Agriculture has for many years grown side by side at the different experimental orchards of Bathurst, Wagga, Richmond—and more recently at Glen Innes and Cowra—most of the varieties of apples to be procured in this and other States, as also some which have recently been imported from both England and America—all of which varieties are being grown and compared, with the definite object of determining which apples, under a given set of conditions, return the best results from a commercial point of view; and as a variety has been found to do well, not only under the conditions existing at the experimental orchard but in private orchards, in which results are comparable, it has been illustrated in colours. The series is necessarily not complete yet, but at any rate the list will not be a long one, there being out of the nearly 700 varieties under trial and observation, possibly not a great many sorts that it is commercially worth while to grow on a large scale.

In Tasmania, the aim of the grower is to have as few varieties as possible, and in the great apple industries of the United States and Canada there is the same tendency. The only reason why so many varieties may be mentioned in this work is that New South Wales possesses so great a range of soils and climatic conditions favourable to apple-growing, that our growers can go further than the orchardists of most of the other States in catering for a wide range of market requirements.

The apple is supposed to be native to south-western Asia and adjacent Europe, and has been mentioned in writings from time immemorial—indeed, it is said that with this fruit Eve tempted Adam. It is still largely grown in temperate climates, and is as much prized to-day as it was two thousand years ago. It is very productive when grown under anything like favourable conditions, and owing to its exceptional keeping qualities, we can, with the aid of cold storage for the later and better keeping varieties, have the apple throughout the whole twelve months. There is no fruit put to more uses by the housewife than this, and if more of it were eaten there is no doubt but that the health of the public would be greatly benefited, particularly if it could be made to take the place of morning and afternoon teas. And what can be nicer than a baked apple, an apple pie, apple sauce, apple fritters, cider, apple jelly, dried apples stewed, apple butter, apple and pine-apple jam, apple trifle, canned apples, apple vinegar, &c., &c.

The public usually prefers a highly-coloured apple for dessert purposes, yet we have many varieties which show little if any colour, and which for dessert purposes are not to be beaten, viz., the Five Crown Pippin and the New York or Cleopatra but these are so well known in the trade and by the public that there is no difficulty in disposing of them for such. On the other hand, we have many highly-coloured varieties of apples which are more suitable for cooking than for dessert, and which are often palmed off on the unwary purchaser as dessert apples. The trade, however, prefers a green apple for cooking purposes, and of these we have several good varieties to choose from.

SOIL.

This fruit thrives in a variety of soils, but is usually found most productive and long-lived on clay loam, and preferably on high and fairly level land, where it is more apt to escape the late frosts; and where the land is level there is very little trouble in looking after the surplus water, which, where the orchard is situated on a hillside, often carries away hundreds of loads of soil, exposing the roots of trees, cutting gullies among them greatly to their detriment, and carrying away the best of the soil which is so much required. As a matter of fact, many orchards so situated have been allowed to go uncultivated on account of this trouble, as it was found that if the orchard was kept in good tilth an occasional heavy thunderstorm would often sweep away most of the loose soil exposing the roots of the trees, and thus greatly depreciating the value of the land.

On several of the basaltic ridges throughout the cooler parts of the State, as well as on some of the heavy clay soils, may be found good apple orchards. It has been generally observed that the same trees grown on different soils will produce fruit varying greatly in size and quality, showing plainly that the fruit is more or less affected by the nature of the soil on which it grows. Some of the best coloured samples I have seen of the Perfection, Rome Beauty, Jonathan, &c., have been grown on the light soils on the Penang Mountain and in similar districts, and it was from the

orchard of Mr. Chas. Robinson that I obtained several of the specimen apples from which the coloured plates were copied.

I have visited a number of orchards in the Orange, Goulburn, Tenterfield, Armidale, Glen Innes, Mittagong, and Bathurst districts, and I found a few good orchards in all of them, showing that there can be found soils in many parts of our State where this fruit will grow if given proper attention, and the places mentioned are only a few of the many in this State where the apple will thrive. There are many growers who do not give their orchards the care and attention necessary to make them pay—in fact, I have observed many in a state of neglect, owing principally to the lack of interest taken in the growing of this fruit.

Budding and Grafting.

The processes of budding and grafting are the methods resorted to for the reproduction of specific varieties of fruits where it is found that such varieties do not reproduce themselves from seed, or cannot readily be grown from cuttings or layers. When once a fruit of good quality has been raised from seed, recourse is had to either budding or grafting, in order the more quickly to secure a stock of trees which will produce fruit in every way similar to the parent tree. In order to perform this operation we remove from the parent tree wood of the current year's growth, from which we remove one bud at a time if we are budding, or, if grafting, the scion or bud stick is cut into short lengths, each of which carries from two to four buds.

The operation called budding is usually performed during the growing season, when the bark slips easily, and consists in taking a bud fron one plant and inserting it in another, or in some other part of the second tree.

Grafting, on the other hand, is usually performed in the spring, about the time the buds begin to swell, and continuing until the tree or stock is about to break into leaf. Some varieties of fruits are better grafted in early spring, before the buds have swollen to any appreciable extent—the persimmon, for instance.

Method of Budding and Grafting.

(See *Agricultural Gazette*, December, 1904.)

Stock.

For stock purposes it is well to select blight-resistant varieties of apples. At the present time the Northern Spy stock is the most largely used, and with every success so far as resisting the ravages of woolly aphis. It makes a very vigorous stock, but not only this variety of apple but many others take the bitter pit. It is just possible that if we used some other strong growing variety which was not subject to bitter pit, and was blight proof, such varieties as the Cleopatra or New York Pippin, Jonathan, Ribston Pippin, Northern Spy, Prince Bismarck, Perfection, and many others which now take bitter pit might not be so badly affected; and I would suggest to our nurserymen the desirability of giving some other resistant stock a fair

trial to see if the stock has any influence over the graft in this respect. If by selecting a better stock than the Northern Spy we can mitigate the loss caused annually from this disease (bitter pit), it will be a great boon to our fruit-growers, and a step forward in the right direction. In speaking of blight-resistant I refer to the American blight, commonly known as woolly aphis.

There is no old tree more easy to work over than the apple, and if, perchance the grower finds he has a few trees which are not profitable they can easily be grafted to varieties found doing well in the district.

Site for an Orchard.

The selection of the most suitable site is very important—not that we need fear but that the tree will grow, as there are many places where it will do well; but owing to the late frosts the crops might often be injured or perhaps destroyed; whereas, perhaps, by the exercise of a little foresight at the time of selecting the site of the orchard, this state of things might have been avoided. It would be well therefore to choose a high rather than a low situation (avoiding cold frosty gullies), with a slope to the north or east, preferably, and sheltered from the westerly winds. When I say slope I do not mean a hillside, but land with sufficient fall to enable the grower to arrange his surface drains in such a manner as will ensure the running off of surface water, without scouring or washing away the surface soil, when the latter is kept in a proper state of cultivation. Naturally, wet country, unless well drained, should never be chosen.

Laying Out the Orchard.

It is not possible, of course, to give anything like definite instructions about a matter of this kind until one has gone carefully over the site, because, with the exception of some of the plain country, it is almost out of the question to find two areas in which soil, aspect, approaches, &c., are identical. If, however, a person about to lay out an area has some sort of a rough standard to go by, he can adopt or modify it to suit the peculiar circumstances of his site or his own tastes. The chief thing to remember is that unless one determines upon some settled plan for an orchard, especially one that is to be planted out by degrees, as the years go by many inconveniences crop up, and the orchardist may have to waste time and money in rearranging things. (See *Agricultural Gazette*, April, 1900, "Plan for laying out five-acre orchard and homestead.")

Wind-breaks.

In almost every instance good wind-breaks should be established, planting them sufficiently far away from the outside row of trees, so that the latter may not be robbed of moisture by them. It is well, where possible, to keep the windbreak at least 40 feet away from the fruit-trees; in places where the wind is very bad, a double would be found better than a single row of

trees. The following trees are suitable for windbreaks, viz., the plane, walnut, chestnut, pinus insignis, or loquat; but not under any circumstances the hawthorn or any tree which will harbor the pear and cherry slug or mussell-scale, as it will be found that one's time can be quite sufficiently employed fighting the pests on the fruit-trees, without having a hedge or wind-break to spray as well.

Preparing the land preparatory to planting.

The preparation of the land before planting is of the greatest importance, and the clearing of timber, ploughing, and subsoiling, should be done some considerable time before it is intended to plant, in order to permit the land to sweeten, as when once the trees are planted it is almost impossible to do this work properly.

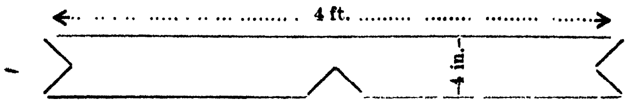
Our usual plan is, to grub out any timber which may be standing on the land intended for orchard purposes, and run all roots to a depth of at least 20 inches, after which we plough to a depth of about 10 inches, and follow the plough with a subsoiler which reaches to a depth of about 18 inches. The land is then left in the rough state for a time to sweeten, after which it is well worked up, and if inclined to be sour a ton of best lime per acre is applied. This deep working and liming before planting will be found the best investment which the orchardist can make before planting his orchard; but under no circumstances should an orchard be started unless it is intended to thoroughy work, manure, prune, and keep down all pests which are found troublesome,—as by the neglect of any or all of these the orchardist cannot hope to make fruit-growing a profitable occupation.

How far apart to plant.

Generally speaking, it is best to give apple-trees plenty of room in the orchard, as by so doing, each tree will have a considerable area of ground from which to draw its supply of moisture and nutriment; and in times of drought or prolonged dry weather, the tree will have sufficient moisture to enable it to carry its fruit; whereas, if the trees are planted too closely together there is great danger during a hot dry summer of both trees and fruit suffering severely from a lack of moisture. It will be found best to plant the trees from 24 to 30 feet apart,—the former in the poor and the latter in the richer soils. Then, by adopting a proper system of pruning, the trees can always be kept well within bounds, and with plenty of room to work around them with the horses at these distances, without any fear of damaging the trees. In Canada and the United States 40 feet apart is quite the ordinary distance, but there the trees grow to a larger size than they do here. In Tasmania, on the other hand, most of the orchards have the trees planted from 12 to 20 feet apart; but there they go in for close pruning, and their rainfall is more assured than in most parts of Australia.

In laying out the orchard be careful to see that it is well done, so that the trees will be in line whichever way you look through the orchard. It is just as easy to lay it out properly as in a slipshod manner, and after all what looks better than a well-planted and cared for orchard?

It is best to begin by using a small rope or wire, stretching this from the base-line to the corresponding line on the opposite side; then put in small pegs every 24 feet (or the distance apart at which it is intended to plant the trees), along its entire length. After the whole orchard has been so laid out, take a double staking-board having three V shaped nicks in, and made as follows:—



Place the staking-board so that the stake fits in the centre notch,—then remove this stake and put it in the notch made at the end of the board, and put another stake in the notch in the opposite end of the board, and continue until the whole orchard is double-staked out in this way. The holes can now be dug between the two stakes; then when it is time to do the planting the double-staking board is again brought into requisition and placed over the hole, so that the two stakes fit into the notches at the end. Then the young tree is held so that the trunk of same fits into the centre notch or just where the single stake stood before the double-staking took place. In either double-staking or planting always work from one end of the row to the other, and always keep the centre notch of the board facing away from you. If one is careful in performing this work it is sure to turn out well.

Trees to plant and Planting.

In purchasing trees one has to be careful to procure the best on the market and to buy from nurserymen who will guarantee them true to name, and who you think will be in the business when your trees come into hearing. There are many such who are trying to give the public the best of their kinds and true to name.

The best age is from one to two years—not necessarily a very large tree but a clean, healthy tree, free from disease and one without a head—a single stem is preferable. You can then cut them back to suit yourself and start as many branches from different points along the young trunk as are thought necessary.

Before planting it is well to examine the roots, trimming off all dried-up fibrous ones and cutting back the larger ones to a few inches in length, making a clean cut on the underside so that the cut will face downwards, and from which cut surface the new fibres will push readily into the soil. In planting the tree see that it is put in upright and not planted any deeper than when in the nursery. Also see that the soil is well settled around the roots. The soil is in best condition for receiving the young tree when it is nice and moist but not wet, as, if in the latter condition, it is inclined to bake and cause cracks, which may allow the air to penetrate to the roots and perhaps kill the tree.

In planting, manure should never be put where it will come in direct contact with the roots of the young tree. Good surface soil is all that is required to fill in with, but if manure is used it may be placed on the

ground as a mulch. After planting it is well to work around the young tree with a fork hoe, from time to time, in order to keep the surface in good tilth. Of course the cultivator must be kept at work to keep the young orchard free from weeds as well as to assist in retaining the moisture in the soil.

Pruning after Planting.

The young trees should be cut back to within from 12 to 14 inches from the ground. When the growth starts we select the young shoots required for the future limbs and which are situated in the best position at different points around the trunk—no two shoots being allowed to start from the same point or height, but they must radiate around the trunk and be left so as to balance the tree. See Fig. I, describing tree cut back just after planting. Fig. II, showing position of young shoots allowed to grow along the trunk of young tree. It will be noticed that no two start from the same place or level.

It is well to see that the limbs are started from the stem of the tree at different points and at distances of from 3 to 6 inches apart radiating around the stem. This will give each branch a firm hold of the trunk, thus laying a good foundation for the future large tree. While the tree is young and growing thriftily it will be found advisable to pinch back once or twice during the summer much of the young growth found shooting up through the centre of the tree. These short spurs will shade the branches, and this pinching back will keep the centre of the tree from becoming too dense, and will encourage the development of fruiting wood on both spurs and branches.

It may be mentioned here that the secret of fruitfulness is not to be found in fancy systems of pruning, but by a close study of the requirements of the tree in the particular place where it is growing, and when once a system is found under which the tree appears to do its best, follow it up and improve on it from time to time as its weak points may be found out. Trees in Australia require a different system to that adopted in Europe, as the conditions under which they are growing are in no wise similar; therefore to any growers who have learnt their methods in European fruit centres I would point out the desirability of remembering these different conditions, though at the same time the experience gained there will be of great assistance to them here. To continue then with our pruning—the head of the tree should be properly thinned out, and for the first few years the whole aim should be to grow a strong healthy tree with a well-shaped head. When this object has been attained, and due precaution has been observed in selecting such varieties as are suited to the individual district (for it must not be forgotten that all varieties will not crop well in every district or climate), the future success of the tree should be ensured. And once the the tree has been properly formed, and has commenced to bear regular crops, very little pruning is required beyond the usual winter clearing out of dead and worthless wood, and the removal of such shoots or branches as have become outplaced by branches better situated and which neither crowd nor tend to put the tree out of balance.

Like other fruit-trees, most apple-trees will not bear regular crops without due attention and a regular system of pruning; for instance, every other year they will produce heavy crops of possibly inferior fruit, while the following year will see little, if any, fruit. By giving the trees a heavy pruning the winter prior to the anticipated heavy crop, and thinning after the fruit has set, the crop may be so reduced that the strength of the tree will not be exhausted, the quality of the fruit will be improved and the prospects for the ensuing year's crop greatly strengthened; as the tree, while still bearing a good profitable crop, will not have its energies overtaxed, and will in consequence stand a much better chance of setting its fruit the following year.

Fig. 1.

Heavy winter pruning induces wood growth; judicious summer pruning, when trees have attained bearing age, causes the tree to develop fruit-bearing wood: root pruning arrests growth and promotes fruitfulness (this latter, however, we have had to practice to a very limited extent only), and thinning crowded spurs and blossom-buds favours a good set of fruit.

In warm districts it will be found best, after once the tree has been properly shaped, to prune very lightly. The observer will notice that different varieties of apples have entirely different forms of growth. Some naturally assume a good shape, others spread out very wide, while others again make a very close upright growth. In the case of a spreading tree, always prune to an inside bud, an upright tree to an outside bud, and keep the tree well cleaned out during its growing period. For example, the "Perfection" and "Rome Beauty" are both very upright growers, while in some districts the "Jonathan" is a very spreading tree, the "Five-Crown Pippin," on the other hand, being naturally an easy tree to form. Fig. 1 shows a 4-year old tree at time of blossoming, where it can be seen that the bloom is well distributed and fully demonstrating the result of this system.

Fig. 2 shows a "Strathden" apple before pruning. Fig. 3 the same tree pruned, and Fig. 4 a tree of the same variety carrying foliage and fruit.

Fig. A is a cutting of last season's growth of apple wood showing leaf buds, while B is a portion of a branch two or more years old, which has produced fruit spurs along its entire length. Throughout some varieties of trees

such spurs will form without any trouble, while with other varieties it is found most difficult to start such wood; in fact, it is impossible to develop much until they attain a good age. Still, in many cases, systematic winter and summer pruning will hasten its development.

It will be well to summer prune or pinch back most of the young shoots starting along the main branches throughout the centre of the tree every summer, December and January being two good months for doing this work. This not only allows more light to reach the centre of the tree, but h lps to make fruiting spurs of that portion of the twig which has been shortened.

What the grower requires is a tree which will return the greatest profit at the least expense, and to do this the tree must be one which can be easily pruned, easily relieved of its fruit, easily sprayed and bandaged for codlin moth, and where necessary moth-infested fruit removed from same, and the trunk must be well protected from the sun. The low-headed tree appears to have all these advantages over those with the high head. By a low-headed tree, I mean one which has only sufficient space on the trunk below the limbs to allow a bandage for use in catching the grubs of the codlin moth. The branches might, therefore,

Fig. 2.—Before pruning.

Fig. 3.—The same tree after pruning.

branch out within 8 inches of the ground, and by the time the tree is 8 feet high it will be large enough to carry from three to eight cases of fruit, all of which can be easily picked without the aid of a step-ladder. The pruning can also be accomplished with the least amount of trouble, as this work too can also be accomplished from the ground. The tree can be easily worked around, leaving very little (if any) more hand work than is left around the higher-headed tree.

Summer pruning is just as necessary as winter pruning, and this work should be started during the first year the tree is planted, and continued from year to year afterwards. This work consists chiefly in shortening back

A B

Fig. 4.

to within 3 or 4 inches of the main branches much of the surplus growth through the centre of the tree, thus allowing air and light to circulate freely and leaving plenty of room for the twigs and spurs to properly develop their fruit spurs. In a thick close-headed tree the wood becomes weakened, and in consequence the fruit spurs do not develop as in a well-spaced tree. It must not be forgotten that there is no better place for a tree to carry its fruit than all along the main limbs, beginning from the point where it leaves the trunk and carrying fruit throughout its whole length; and it stands to reason that a tree will carry more fruit with less damage to either tree or fruit during windy weather on these stiff branches than on long, weak, willowy ones which are blown about and broken during stormy weather when carrying a crop.

(*To be continued.*)

The Feeding of Farm Stock.

(Continued from *Agricultural Gazette*, December, 1904.)

F. B. GUTHRIE.

Classification of Feeding Stuffs.

It will be convenient to classify the different fodders in the market according to the particular ingredient in which they are especially rich, or which gives them their character as a food.

None of them are suitable for feeding without admixture for any length of time, and the feeder's art consists in so combining them as to provide a cheap and palatable food approaching in composition one or other of the rations which experience has shown to be the most suitable for the particular animal and the particular object in view. Feeding-stuffs can be divided into six classes, according to their richness in the different ingredients.

Class I.—Foods rich in Albumenoids.

First in order of nitrogen-content come the different oil-cakes, decorticated cotton-seed cake being the richest, with over 40 per cent. albumenoids, followed by linseed and coco-nut cake, with about 30 and 20 per cent. respectively. The leguminous seeds come next, peas and beans containing from 20 to 22 per cent. albumenoids. Another fairly nitrogenous feed is dried brewers' grains, the dried malt residues after the sugar has been extracted by the brewer, both these and malt-sprouts (the dried shootlets of the germinating barley) being used extensively for feeding cattle in other countries.

Dried brewers' grains contain about the same amount of nitrogenous matter as beans and peas. Bran comes next with about 12 per cent., and then the cereals, oats, rice, wheat, barley, maize, with from 10 to 12 per cent. albumenoids. The best clover hay contains about the same quantity, hay from the grasses being somewhat lower in nitrogen. Good lucerne hay contains as much as 14 per cent. nitrogenous matter.

Class II.—Foods rich in Fat or Oil.

Amongst the fatty foods, some of the oily seeds, such as linseed, sunflower seed, &c., come easily first, linseed itself containing over 34 per cent. of oil. Such seeds in the shape of ground meal may be occasionally fed, but both on account of their cost and their extreme richness in oil need not be considered under the ordinary stock foods, except under special circumstances. The crushed cakes of these seeds from which the oil has been pressed are waste-products of the highest economical value as a food. They are extremely rich, as we have

already seen, in nitrogenous material, and contain a considerable proportion of oil, varying according to the nature of the original substance and the process by which the oil has been extracted. Of these, linseed, cotton seed, rape seed, and coco-nut cake are the richest in oil, running from 8 per cent. in the case of rape cake up to 11 or 12 in the case of linseed or coco-nut.

Dried brewers' grains are also fairly rich in fat, containing as much as 8 per cent. Of the cereals, oats and maize are the richest in fat, with 5 to 6 per cent., whilst bran contains about 4 per cent.

Class III.—Foods rich in Carbohydrates.

In this class are found the cereal grains, wheat and maize heading the list with over 70 per cent. carbohydrates (principally starch). Bran containing about 50 per cent., and the pulses, peas and beans, about the same quantity. Brewers' grains and meadow-hay come next with from 40 to 45 per cent., and these are followed by the straws of the different cereals, with an average content of 35 to 37 per cent., and the oil-cakes, which contain from 30–35 per cent. carbohydrates.

Class IV.—Foods rich in Mineral Matter.

Of the foods rich in mineral matter, the oil-cakes are all fairly high, with an average of 6 to 8 per cent.; bran and hay (clover and grass) being a little lower. The cereal straws are also fairly rich in mineral matter, containing between 4 to 5 per cent. The cereal grains are not particularly rich in salts, except rice, rice-meal being sometimes exceptionally high, and containing as much as 8 per cent., of which phosphates form a considerable part. Phosphates are also well represented in the ash of the oil-cakes and of bran; the ash of the cereal straws, on the other hand, being low in phosphates.

The above comprise the foods in which one or other of the nutritive ingredients predominate, grouped into classes according to their richness in these essentials. A few of them, such as the oil-cakes, brewers' grains, &c., we see are rich in more than one such constituent.

These are all concentrated foods, the percentage of water present in any of them never rising above 16 per cent., and the amount of fibre, or indigestible matter, never exceeding 10 to 11 per cent., except in the case of the hays and straws.

We have already seen that both succulence and bulk of food are factors of the first importance in the making up of rations; it is, therefore, necessary, in order to complete the list, to add the classes of bulky food characterised by succulence and by the amount of indigestible matter.

Class V.—Succulent Foods.

The most watery of the ordinary farm foods is the turnip, which contains over 92 per cent. of water; the swede, mangel, carrot, and similar roots follow next, with cabbage and the green tops of roots and vegetables, their water content ranging from 89 to 85 per cent. Clover (growing) contains about 83 per cent., and pasture-grass and

potatoes about 75. Green fodder—that is, cereal crops cut for green feed—vary from 70 to 79 per cent. water. Of these foods, several of the roots may be characterised as sugar-crops, notably turnip, swede, mangel, and beet, whereas the potato contains 16 per cent. or so of starch.

Class VI.—Foods rich in Fibre.

The cereal straws and hay, both of clover and pasture-grass, are included in this class; the straws containing from 68 to 75 per cent. indigestible fibre, clover and meadow hay, on the other hand, 25 to 26 per cent.

All the above figures require to be considered in the light of the different digestibility of the various ingredients. This varies, as we have seen, not only in the different kinds of food, but with different animals. Thus ruminants are able to digest 81 per cent. of the nitrogenous matter in lucerne hay, as against 73 per cent. digested by horses; 72 per cent. of the carbohydrates in lucerne hay and 45 per cent. of the fat are digestible by ruminants, whereas horses digest only 70 per cent. of the carbohydrates and not more than 14 per cent. of the fat. Pigs, again, are able to utilise 84 per cent. of the protein and 98 per cent. of the starch in potatoes, whereas ruminants can only assimilate 45 and 90½ per cent. respectively of these ingredients. Ruminants, again, can always digest a larger proportion of the fibrous material than can horses or pigs. They digest, for example, about one-half of the fibre in wheaten straw, whereas horses only assimilate about 18 per cent.

The digestibility of any one food also varies very considerably, according to the nature of the other feeds with which it is mixed. On account of the great difficulty attending the accurate carrying out of digestion experiments, no very large number of such experiments are available, and the science of the economical feeding of farm stock can only be said to be in its infancy. At the same time, we have sufficient data to enable any stock-feeder to compound for his stock rations which shall be not only suitable for the purpose but economical, as opposed to the wasteful rule-of-thumb methods at present too largely adopted.

Dietary Standards.

The composition of the ration will vary according to the animal to which it is fed, its age, and the purpose to which it is put.

We have to distinguish between a maintenance diet—the diet required for the animal when kept at rest or doing very light work—and that required by an animal doing more severe work.

Special rations are required for fattening animals, for dairy cows, for young growing animals, and so forth, and the requirements of animals under these different circumstances vary very considerably.

It will readily be seen that the subject is a very wide one. It is one that will amply repay a little careful study on the part of the farmer. In dairy-farming, more particularly, feeding on rational lines is an essential to the attainment of the best results.

These few notes are not intended to do anything more than to draw attention to the general principles of the subject and to the different points which have to be considered in devising a suitable ration for different classes of farm stock.

These points may be summed up as follows:—

Kind of animal.

Age.

Purpose of feeding.

Composition of fodders of which the ration is composed.

Proportions of digestible nutriment in the ration.

Cost of the different fodders of which the ration is composed.

Manurial value of excreta.

Palatability, variety, bulk, &c.

Rations to meet all these different requirements will be found in the recognised text-books on this subject. Amongst those embodying the most recent experiments in the feeding of animals, the Americans are amongst the best and the most readily available. Jordan's "The Feeding of Animals" is of handy size and compact. Henry's "Feeds and Feeding" is a larger work, and deals more exhaustively with the subject, whilst Armsby's "Principles of Animal Nutrition" deals more especially with the scientific aspect of the matter.

The above notes have been written with the object of drawing attention to this subject, which is in danger of being neglected in this State. It was thought that a discussion of the matter in its barest outline may direct attention to the great importance of the rational feeding of animals, and lead to the more careful study of the recognised authorities on the subject.

Crop Returns.

The attention of readers of the *Agricultural Gazette* is invited to the form concerning Crop Returns enclosed with certain copies of this issue. If possible it should be completed and returned to reach the Government Statistician, Sydney, not later than 17th June, 1905. For the convenience of those who are kind enough to furnish the desired information, the forms are stamped and addressed ready for transmission through the post.

Forestry.

SOME PRACTICAL NOTES ON FORESTRY SUITABLE FOR NEW SOUTH WALES.

J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

IX.

The Mitigation of Floods by Forestry Operations.

I.—The situation ; denudation.
- (*a*) The outlook serious.
- (*b*) European and American experience.

II.—Intelligent control of ringbarking the beginning of all remedial measures :—
- (*a*) Shelter for stock should be adequate.
- (*b*) Danger of cutting trees too near the watercourses.

III.—Deviation of roads.

IV.—Falling in of banks.

V.—Floods and weeds.

VI.—Some miscellaneous factors in erosion :—
- (*a*) Boulders.
- (*b*) Dead trees.
- (*c*) Stock.

VII.—Remedial and preventive measures :—
- (*a*) Control of ringbarking.
- (*b*) Fencing.
- (*c*) Embankments.
- (*d*) Chamfering of banks.
- (*e*) An American proposal.
- (*f*) Planting and conservation.
    1. Natural bank protectors.
    2. Other bank protectors (exotic).
    3. Plants recommended for Upper, Middle, and Lower Hunter.
    4. Nurseries.

VIII.—Summary of the measures recommended for mitigation of floods.

Appendix.

If one's knowledge of Australian forestry were confined to what one sees in letters to the newspapers, one would imagine that its sole object is the furnishing of timber to the saw-miller. That is but one object, albeit an important one, other phases of forestry being the combating of drift-sand, planting for the mitigation of floods, the up-keep of river banks, the planting of shelter belts, and so on. The forester has as much right to claim credit in the national balance-sheet for improvements such as these as from the revenue arising from timber royalties. The report of the Western Lands Commission has vividly brought home to us the fact that dealing with sand-drifts is not a coastal question confined to Sydney and Newcastle, but one of magnitude to the far West, and one that must be coped with unless we are prepared to abandon large areas of pastoral country. The question of dealing with drift-sand belongs properly to a Forest Department, and it is of such great local importance to both east and west of our State that I would not continue to leave it to be dealt with in a desultory manner, but would make a sub-branch of the Forestry Department responsible for this service.

Let me deal with the subject of the mitigation of floods by forestry operations. What follows is based upon a paper that I read before the Royal Society of New South Wales in 1902, with reference to the Hunter River, but most of what is written is of general application.

I.—*The Situation—Denudation.*

Coming to first principles, the beginning of streams and floods with which we are concerned is—1. Rain falls more or less on the land. 2. Some sinks into the ground. 3. The remainder drains away. Thus a single paddock may be an object lesson in regard to forces at work in the whole of New South Wales, as I will endeavour to show presently. I shall seek to prove that our treatment of paddocks affords an illustration of the truth of the ancient saying to the effect that—"Every act of man is the forerunner of a chain of consequences, of which no one can foresee the end."

The natural forests on the rounded steep hills of the Upper Hunter have, in many cases, been destroyed, and the sheep and cattle tracks are everywhere in evidence, even in the steepest places. The innumerable sheep tracks are accentuated, and the ground everywhere is pulverised by the feet of the sheep wandering after the scanty herbage during a period of drought. When the rain falls, much of this pulverised soil, carrying with it grass plants (latent) and seed of grasses and various forage plants, must be washed into the creeks, and again into the Hunter, which becomes discoloured. As the country is nearly all rung, it is to be hoped that many of these seeds will be arrested by the fallen timber. As we proceed towards the hills from the watercourses, we come to the clay and sandy land and to the masses of undecomposed basalt, which have no manurial value, but are a potentiality for future ages.

The poorer uplands can sometimes only be profitably used in conjunction with the rich flats on which they abut. This is clearly

brought out in the evidence* in regard to the proposal of the late Mr. Price to dam the Hunter below Denman. In fact, if we lose our flats, large additional areas will be thrown out of occupation.

(*a*) *The Outlook serious.*—My view is that it is only a matter of a brief historical period when, unless preventive steps are taken, these rich river and creek flats will find their way into the Pacific Ocean. Some people, including men of great experience and careful thinkers, are, however, of a different opinion. They view the erosion with more or less equanimity, considering that what is taken off one bank is deposited on the other. Of course, erosion is going on all over Australia, and to what extent compensating influences are at work is a question for geologists; but I believe the amount of loss far exceeds the gain.

Washing away of rich river flats, Mombri Creek, Liverpool Range, N.S.W.

Note the rounded basalt stones.

Judge Docker—photo.

I do not like the *laisser faire* argument as applied to the Hunter. It seems an argument analogous to that, because there will always be evil in the world, efforts for the betterment of man's condition should be abandoned. As a matter of fact, man's existence in the world is dependent on his maintaining an incessant warfare against what are called "the forces of nature." As regards the particular case now under consideration, it is, of course, a matter as to how far expenditure of effort and money are justified by the results they secure.

Let us not act as if we were content simply for the agricultural flats to last our time, and then—"Après nous le déluge." Like the nuggets of gold, and the forest monarchs (now sadly diminishing) we convert into timber, human agency has done nothing to produce them. Let us not deal with these rich flats simply as if they are capital to be got rid of in a brief period, but rather let us act in the capacity of faithful trustees,

* "Hunter River Floods Prevention." Minutes of Evidence, Parl. Stand. Committee, Public Works, Questions 1128, 1355, &c. 1901.

realising that maintenance of the property is expenditure that must be incurred, and that it is vital to the very existence of the property.

I do not wish to weaken my argument by overstating the case, but wish, at the very outset, to show how, in other countries, the seriousness of denudation by rivers is realised, and the conservation of forests is looked upon as a palliative.

(*b*) *European and American Experience. A.*—The rivers Volga, Garonne, and Loire afford special lessons to us, and since the injudicious felling of trees is attended by evil consequences the wide world over, we should lay the lessons to heart in New South Wales.

"The Alps and Pyrenees, exposed to the same treatment, have been similarly affected. The deforestation paralyses the development of the pastoral industries in these regions by lowering the limits of forest vegetation. The valleys are ravaged by a devastating erosion. Entire mountains slide down slowly, carrying with them the pastoral villages which they bear on their surface, accumulating ruin and disaster.*

"These processes do not affect the mountain alone. For, by the very fact of this deforestation, the rich plains of the Garonne and the Loire are subjected to disastrous floods which make the fate of agriculture in these regions very precarious. This state of things has not failed to arouse apprehension among the inhabitants. Researches with regard to the question have shown that the devastating character of these inundations is due to the destruction of the forests which formerly covered the Central Plateau and the Pyrenees. The waters, no longer absorbed and regulated by the forest vegetation, flow away on the surface in enormous and sudden waves. The débris thus carried away in vast quantities contributes to the formation of barriers, and gives to the waters their destructive power.

"But the danger does not cease there. The navigation of the great rivers gradually silted up by this waste from the mountains is rendered very difficult. So much is this the case that even Russia, a country so uniformly flat, is threatened in the use of its great waterway, the Volga. The investigations ordered by the Russian Government have demonstrated that this is the result of the drainage of the marshes and the deforestation of the low hills which give birth to the river."†

B.—"The soil, once denuded of its forests and swept by torrential rains, rapidly loses first its humus, then its rich upper strata, and finally is washed in enormous volume into the streams, to bury such of the fertile lowlands as are not eroded by the floods, to obstruct the rivers, and to fill up the harbours on the coast. More good soil is now washed from these cleared mountain-side fields during a single heavy rain than during centuries under forest cover.

* Demontez, "Traite pratique du reboisement, etc.," 2nd edition, 1882. Also J. Croumbie Brown, *op. cit.*

† A. Woeikof, "De l'Influence de l'homme sur la terre." *Ann. de Geogr.*, X, 1901. (Quoted by Marcel Hardy in *The Scottish Geogr. Magazine*, May, 1902.)

"The regulation of the flow of these rivers can be accomplished only by the conservation of forests." (President Roosevelt's letter of transmittal to the Senate of a report of the Secretary for Agriculture relating to the Southern Appalachian region, 1901.)

C.—I will conclude with a graphic account by Mr. McGee of the destruction going on at present to form the "bad lands" of the State of Mississippi. I do not think that truth has been sacrificed to fine writing, and do feel that what has been taking place in the Mississippi Valley has its counterpart in the Hunter Valley, New South Wales. The quotation is from Bulletin No. 7 of the Forestry Division of the United States Department of Agriculture.

"With the moral revolution of the early sixties came an industrial evolution; the planter was impoverished, his sons were slain, his slaves were liberated, and he was fain either to vacate the plantation or greatly to restrict his operations. So the cultivated acres were abandoned by thousands. Then the hills, no longer protected by the forest foliage, no longer bound by the forest roots, no longer guarded by the balk and brush dam of the careful overseer, were attacked by rain-drops and rain-born rivulets, and gullied and channelled in all directions; each streamlet reached a hundred arms into the hills, each arm grasped with a hundred fingers a hundred shreds of soil, and as each shred was torn away the slope was steeped, and the theft of the next storm made easier.

"So, storm by storm and year by year, the old fields were invaded by gullies, gorges, ravines, and gulches, ever increasing in width and depth until whole hillsides were carved away, until the soil of a thousand years' growth melted into the streams, until the fair acres of ante-bellum days were converted by hundreds into bad lands, desolate and dreary as those of the Dakotas. Over much of the upland the traveller is never out of sight of glaring sand wastes, where once were fruitful fields; his way lies sometimes in, sometimes between gullies and gorges—the 'Gulfs' of the blacks, whose superstition they arouse—sometimes shadowed by foliage, but oftener exposed to the glare of the sun reflected from barren sands. Here the road winds through a gorge so steep that the sunlight scarcely enters; there it traverses a narrow crest of earth between chasms scores of feet deep, in which he might be plunged by a single misstep. When the shower comes, he may see the roadway rendered impassable, even obliterated, within a few minutes; always sees the falling waters accumulate as viscid mud torrents of brown or red, while the myriad miniature pinnacles and defiles before him are transformed by the beating raindrops and rushing rills so completely that when the sun shines again he may not recognise the nearer landscape.

"This destruction is not confined to a single field, nor to a single region, but extends over much of the upland. While the actual acreage of soil thus destroyed has not been measured, the traveller through the region on horseback daily sees thousands, or tens of thousands, of formerly fertile acres now barren sands; and it is

probably within the truth to estimate that 10 per cent. of upland Mississippi has been so far converted into bad lands as to be practically ruined for agriculture under existing commercial conditions, and that the annual loss in real estate exceeds the revenues from all sources. And all this havoc has been wrought within a quarter of a century. The processes, too, are cumulative; each year's rate of destruction is higher than the last.

"The transformation of the fertile hills into sand wastes is not the sole injury. The sandy soil is carried into the valleys to bury the fields, invade the roadways, and convert the formerly rich bottom lands into treacherous quicksands when wet, blistering deserts when dry; hundreds of thousands of acres have been destroyed since the gullying of the hills of a quarter of a century ago. Moreover, in much of the upland the loss is not alone that of the soil, *i.e.*, the humus representing the constructive product of water-work and plant-work of thousands of years. The mantle of brown loam, most excellent of soil stuffs, is cut through and carried away by corrosion and sapping, leaving in its stead the inferior soil stuff of the Lafayette formation. In such cases the destruction is irremediable by human craft—the fine loam once removed can never be restored. The area from which this loam is already gone is appalling, and the rate of loss is increasing in geometric proportion."

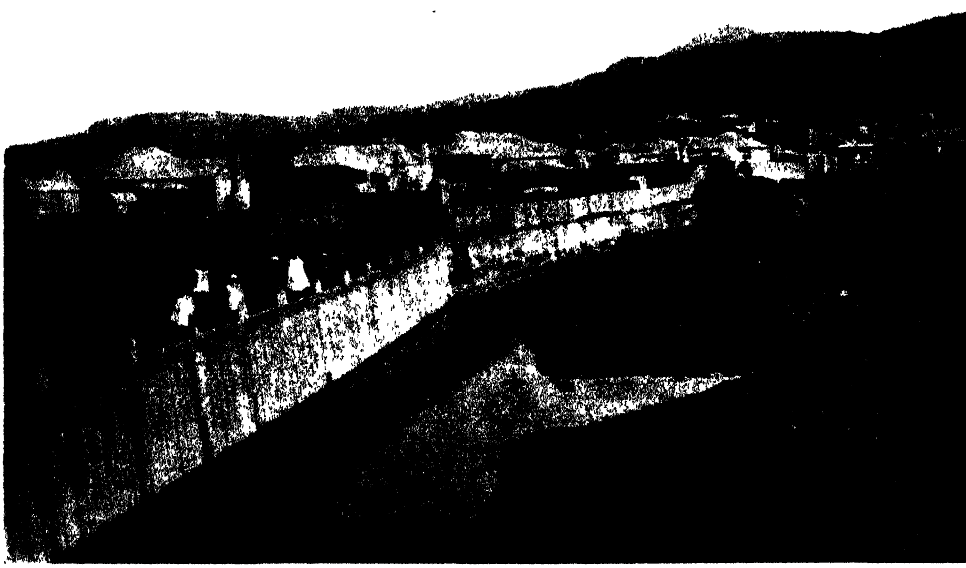
II.—*Intelligent Control of Ringbarking.*

Going back to ultimate beginnings, to the creeklets, the source of all the troubles is the indiscriminate ringbarking and cutting down of vegetation by individual owners. The ringing or felling of trees in paddocks is, of course, necessary; but the requirements of the natural drainage seem not to be considered. The consequence is that in the dry creeks rifts appear, which gradually widen, and carry soil, often the best soil, into the creeks, and so on, *ad infinitum*. The remedy lies in the intelligent control of ringbarking. Where there is an even contour of the land the operation is usually safe enough, but directly the land shows widening depressions that may carry water to lower levels, then operations should be undertaken with caution, since the water goes along the line of least resistance. In every paddock there is a getaway for the water, or if not, the water will make one. This getaway is the weak point of the paddock, or other tract of country; but very often it receives no special notice or consideration. The trouble is accentuated in rich lands simply because of the finer texture or friability of such soils.

The State of New South Wales is mainly made up of paddocks! The paddock is the unit in considering the effects of erosion. Much of the mischief has already been done, but intelligent conservation of existing and future trees has vast possibilities for good. It ought to be made penal to ringbark up to a certain distance from a watercourse, or to cut down a river oak on any of the rivers (watercourses), except under a special license only to be obtained after due inquiry. The reason of the suggestions is that improper

ringing or felling affects the riparian owner lower down, and he has quite enough difficulties to contend with, which are beyond human control, to be victimised by the ignorant act of his fellow-man higher up the steam. I could give an instance where a man cut down river oaks to make culverts; the river oak timber is now perished, and if he had gone but a few yards away he could have got almost imperishable ironbark. He now has to repair his culvert, but his river oaks are gone, his banks are falling away where he removed them, and a larger culvert is now required. In the case of a casual labourer, this would have been termed living from hand to mouth. In the present instance, it is miserable expediency and opportunism unworthy of thinking men. If the result of acts like these would alone affect the doer, we could view the matter with complacency.

(*a*) *Shelter for stock should be adequate.*—Shelter for stock is necessary; a few acres of trees should be left, and not an odd tree or two,



Washing away of the banks of rich soil and wooden embankment, Page River, Murrurundi, N.S.W.

which die out. The ruthless cutting down or sapping of trees has its basis in self-interest. A man desires to get the fullest advantage out of his land, and until it comes home to him that he is acting against his own interest in not conserving sufficient trees, he will blunder along. The advantage of leaving adequate shelter for stock is so obvious as not to be arguable.

(*b*) *Danger of cutting trees too near the watercourses.*—All over the State people have made a mistake in sapping too near the rivers and watercourses. The dry, dead timber at the edge of the watercourse no longer holds the banks, for the reason that their roots have

shrivelled and decayed, and have no gripping power; then the tree gets top-heavy, and breaks down the banks, and the second chapter of mischief starts.

The innumerable creeks will doubtless require to be dealt with in any effective remedy for the mitigation of floods. There is evidence everywhere of broadening streams, of banks breaking down, and good soil washed away. Apple (*Angophora intermedia*) and River Oak (*Casuarina Cunninghamiana*) doubtless filled these flats, and they have been removed in order to cultivate the rich land to the fullest extent. The denudation is going on in geometrical progression. There are farmers even in a small valley like that of the Page, near Murrurundi, who have lost as much as 50 acres through breaking down of banks.

What we see in the small creeks is repeated in the big rivers, so this is not a local matter merely as regards the little creeks. With friable banks, every fresh carries down soil to the lower levels, and the stronger the current, of course, the greater the débris. This tends to work destruction at the lower levels. By all means, therefore, let us encourage people to prevent the erosion of the land higher up. It is not only that land is lost by erosion, but the land becomes a motive power to destroy property lower down. Much of the silt that people complacently see deposited on their ground is, of course, the soil of some unfortunate cultivator.

The matter might settle itself eventually by there being no more friable material to be washed away from the upper lands. If one could estimate the percentage of "flats" area which has disappeared since the advent of the white man on some of the Upper Hunter streams, I think the result would be startling.

III.—*Deviation of Roads.*

The annual cost to the Roads Department of deviations necessitated by washaways and repairs necessary by washaways must be very considerable, and having made special inquiries, I find that many of these washaways are the direct result of the destruction by private owners of trees along the getaways for water. If the cost to the Roads Department and to private citizens of road deviations (with culverts, &c.) necessary through the washing away of the banks of rivers and creeks in the Hunter Valley were available, I think it would surprise a good many people.

If the Public Works Department were to select, say, 100 definite places on rivers, creeks, and furrows, in cleared land (what I might term "incipient creeks") and photograph them every year for, say, five or ten years, the results would be of the highest educational value. They would be of value to the whole State, for the phenomena of aqueous denudation are in operation everywhere, although the results may not be, in most places, so disastrous as on the Hunter.

IV.—*Falling in of Banks.*

These friable, rich soil banks of the Hunter and some of its tributaries fall to some extent, wet or dry. In dry weather they crack and

tumble into the bed of the stream because of their lack of cohesion. In wet weather the rain soaks them, expansion takes place, cohesion again fails, and the result is the same. These banks are, in fact, in a condition of unstable equilibrium.

V.—*Floods and Weeds.*

Another aspect of floods often lost sight of is the havoc committed in the lower lands by the transmission of weed seeds and plants to lower levels, *e.g.*, Nut Grass (*Cyperus rotundus*), Yellow or Prickly Poppy (*Argemone mexicana*), Yellow Indigo (*Cassia spp.*), Bathurst Burr (*Xanthium spinosum*), Yellow Thistle (*Kentrophyllum lanatum*), Chinese Thistle (*Centaurea calcitrapa*), and other thistles and pests of various kinds. The undisturbed propagation of weeds in the bed of an upper creek thus means loss to any rich lands on a lower level. Therefore, although for engineering purposes the consensus of opinion is to work from Newcastle, my view as regards weeds prevention is to begin as high up the Hunter and its tributaries as possible. They not only float the seeds down, but nice rich silt to give the weed-plants a fair start in life.

Washing away of banks, the Hunter River, Muswellbrook, N.S.W.

Judge Docker—photo.

VI.—*Some Miscellaneous Factors in Erosion.*

(*a*) *Boulders.*—The small stones and boulders in the bed of a stream are set in motion by floods, and forming eddies, &c., grind down the banks. Good rich basaltic land is very fine grained, and washes away readily. The stones which are always found in it more or less help to break it away. Sometimes they form masses of considerable weight. The black soil everywhere rests on a bed of gravel.

The water gets underneath and through the black soil, these gravelstones facilitating the circulation of the water and the disintegration of the superimposed soil.

(*b*) *Dead trees.*—The dead trees and branches felled for stock, unless they are dry enough for burning before the floods come, do much damage. So many river oaks (and other trees) are cut down during a drought, that if a flood comes soon, enormous damage is done through these dead trees tearing down the creeks and rivers. Dead timber, of course, threatens the bridges, and also churns up the banks and works destruction. The courses of creeks are so irregular and the water comes down so suddenly, that a stream may become a succession of grinding whirlpools.

"There are evidences that in former times the beds of nearly all our rivers, especially the larger ones, occupied from time to time the lowlands adjoining their present course. These ancient depressions or beds may now be readily traced—the original courses suddenly changed by the blocking up of the river by trees or logs with rubbish in time of flood. In 1849 I made some surveys in the town of Gundagai, which was situated on an island formed by the Murrumbidgee and an anabranch. Consequently, when the flood came there was no escape for the inhabitants, and seventy persons were drowned. I took an early opportunity of visiting this river from Yass downwards, and, shortly on rounding a steep point, came upon a remarkable excavation, 3 or 4 feet broad, about 2 feet deep, too broken and uneven for spade work—something approaching to three or four furrows of a plough. I followed it up and soon ascertained the cause, a large-sized gum tree had been washed down head first, and would have been carried completely across the low flat at the base of the hill; but it was firmly hled by a powerful root which acted like an anchor, but had torn up the ground so far *en route*, and thus caused this remarkable excavation. The cause of these anabranches and islands in these rivers was thus readily explained." (J. F. Mann, in a letter to the author.)

(*c*) *Stock.*—I desire to emphasise the damage caused by the trampling of horses and cattle, and by the nibbling and eating out of all vegetation in drought seasons. Let each landowner have his special crossing places for cattle, such places to be so arranged and prepared that the minimum damage of banks may be secured. (See pages 536–537.)

To Sharpen a Disc Harrow.

First get a crank of 15 to 20 inches stroke, that will fit solid on the end of the disc axle. Then take off seat and lever and turn disc upside down. Block up so that the crank will easily turn it, and with two hammers, one heavier than the other, straighten out all kinks around edges of discs. Then while one man turns disc slowly with the crank, have another man hold a good flat file, or a piece of a grindstone, against the inner or convex edge of each disc, one at a time, of course. The file and the man at the crank does the work.—*The Farmer's Advocate.*

A WHEAT GRASS

ISCHÆMUM AUSTRALE, R BR.

Useful Australian Plants.

J. H. MAIDEN,
Government Botanist and Director, Botanic Gardens, Sydney.

No. 94. A Wheat Grass (*Ischæmum australe*), R.Br.

Botanical Name.—*Ischæmum*, already referred to; *australe*, Latin, southern (Australian).

Botanical Description.—(B.Fl., VII, 519):—

Stems from a shortly decumbent base or creeping rhizome, erect, 2 to 3 feet high, but not stout.

Leaves rather narrow, glabrous or slightly hairy in the typical form, the nodes always bearded, the upper sheaths very long.

Spikes two together on a long peduncle, sessile and erect, 1½ to 3 inches long, the rhachis and pedicels slightly ciliate.

Spikelets 3 lines long or scarcely more, otherwise the same as in *I. triticeum.*

Awn of the sessile spikelet ¼ to ½ inch long, of the pedicellate spikelet shorter or reduced to a short point.

Value as a fodder.—A coarse, harsh grass, only nutritious when young: when old, stock never touch it except when hard pressed. Bailey remarks that it has a deep-running rhizome, and is thus enabled to stand a length of dry weather, and continue to afford a bite for stock after others have given up. Mr. Seccombe, with admittedly limited experience of it, speaks of it as a valuable acquisition, growing continuously through hot and cold weather, for so far the winter has in no way affected its appearance or growth. It has moreover, proved a continuous seed producer.

Habitat and Range.—Found near moist places from the Port Jackson District northward to Queensland and Northern Australia, confined to the coast districts.

EXPLANATION OF PLATE.

1. Habit of plant.
2. A pair of spikes.
3. Part of a spike showing the pair of spikelets in the alternate notches of the rhachis.
4. A pair of spikelets.
5. A single spikelet with one bisexual and one male flower.

A. Outer glumes.
B. Fertile flowering glume.
C. Sterile flowering glume.
D. Paleas.

Co-operative Fruit Spraying in Canada.

In order to assist small fruit growers, and make a more thorough eradication of fruit orchard pests throughout the country, the co operative plan of spraying has been put into operation. The chief of the fruit division in the Canadian Department of Agriculture says :—

"Though the fruit-growing public of Canada has had instruction and encouragement in spraying for a number of years, it has begun to appear evident that small owners as a rule, do not make a success of spraying by the ordinary methods. Many difficulties have combined to bring about this result. Consideration of this fact induced the Canadian Minister of Agriculture to authorise the conducting of systematic experiments in power spraying during the spring and summer of 1903. The most successful of these were carried on in the neighbourhood of Woodstock, Ont., and resulted in the production of almost the only No. 1 fruit in that section. The season happened to be a particularly bad one for fungus diseases in that portion of Ontario, and the sprayed orchards yielding 80 and 90 per cent. of perfect fruit were in marked contrast to those which surrounded them, in which the yield of No. 1 fruit varied from 20 to 50 per cent. Without going into details, it may be stated that the spraying which was performed four or five times on each orchard at a fixed charge to the growers, amounting to rather less than actual cost, was found both effective and economical, though the route was long and straggling, and some of the orchards were in by no means perfect condition as regards pruning and otherwise. The operation cost less than 5 cents a tree for each spraying. One should not speak with too much certainty after a single season's experience, but it seems probable that 5 cents per 'tree spraying' will cover the cost for well-grown apple trees. A two and one-half horse-power engine was used, giving a steady pressure of 100 pounds, with a 300-gallon tank and three lines of hose, carrying six nozzles each. Quarter-inch hose was used for the sake of lightness, and was found very satisfactory. The Bordeaux mixture (with Paris green added) was the only one applied, except in one or two cases toward the end of the season. Arrangements are being made by the fruit division for the carrying on of a similar demonstration in the Annapolis Valley in Nova Scotia, where Inspector Vroom has charge of the preliminary arrangements. *It need hardly be said that the fruit division will not make a permanent business of spraying orchards for owners.* The object of the demonstration is to induce growers to unite in groups wherever 3,000 or 4,000 trees can be had within a distance of about five miles from end to end, and arranged as nearly as may be in a circle. Such a combination of growers could afford to purchase an outfit among them at a cost of something like 300 dollars (about £60)."

Starting a Small Farm in the Glen Innes District, N.S.W.

R. H. GENNYS.

I FEEL diffidence in contributing some remarks on this important subject, but practical experience, coupled with a fair amount of success here, so far, entitles my conclusions, I think, to some consideration. I shall confine myself this month to a few important headings, leaving details for a future issue.

Mixed farming will pay the best, but make up your mind what your main product and source of income is to be. Remember you are in a temperate climate, with a copious rainfall, the average situation being over 3,000 feet above sea-level. You will get frosts and severe ones too, and your summer is short. Solely tropical plants cannot be expected to flourish. Select land best suited to your main product.

Oats will flourish on all but the very poor soils, which should be avoided in every case except for grazing suitable breeds of sheep and cattle.

Wheats, Barleys, and Ryes.—Choose land with good natural drainage, or that can be drained at reasonable cost; avoid the very low wet land for grain.

Maize, Millets, all Ensilage Crops, Perennial Rye Grass, and Oats.—The rich heavy soils are eminently adapted for growing these, and are practically inexhaustible if a fair system of rotation in cropping be adopted. Manitoba wheat for hay also does splendidly on the heavy soils, but not so sure for grain.

Potatoes, and other Root crops.—Friable, reddish, and well-drained land is the best. Avoid all very heavy clays. Much of the soil in the District is well adapted for potatoes, and they can be produced equal to anything in the State.

Dairying.—Choose the richest land, which will produce abundant summer grasses, and grow everything required for winter feed for stock.

Fruit-growing, as yet, should not be relied on as a primary product in this district. The distance from market is too great to make it a dependable source of income; but every farmer should plant an orchard with carefully selected fruits; as the temperate climate fruits such as apples, cherries, plums, pears, gooseberries, raspberries, &c., can be grown to perfection. Some of the cherries, plums, apples and gooseberries being unsurpassed for size and excellency of flavour. For an orchard, choose high well-drained land, on a slope, with a grade not too steep, or soil may wash away. A westerly aspect here, I think,

preferable to an easterly, as the latter situation brings trees into blossom earlier and they are apt to suffer from late frosts. Good wind-breaks, however, should be planted for protection against cold and dry winds.

Wool.—Nearly the whole of the district is suitable for wool-growing, and the New England wool always fetches a high price in the market. The higher lands are the most suitable for wool-growing. For mutton sheep which is the farmer's most profitable animal, the crosses of the Merino with the Suffolk, Shropshire, or Lincoln are among the best known; the black faces are coming rapidly into favour.

Having selected the most suitable soil for the chief produce intended to be introduced, see to the water supply. In most districts this should be one of the first items considered; but in Glen Innes District it can be conserved without difficulty almost anywhere, and if there are no streams available, dams or tanks of fair size should be made, sufficient for all stock intended to be carried in the driest seasons, which here are few and far between; but better be on the safe side and have at least one large permanent dam, with a depth of at least 12 feet. Fence three sides leaving a road way (which should be stone-pitched) for stock to water at. If drains require to be made, the grade should not be more than 6 inches to the chain, to prevent washing away and forming gullies.

Select a high sheltered spot for the homestead with an easterly aspect, if possible, and sheltered from the cold westerly winds.

Lay out the whole of the farm on a plan, and work up to it; but, of course, some alterations will have to be made as you proceed. Choose your base line,—if possible, a surveyed one, and lay out all your paddocks as far as practicable at right angles to this. Then the opposite sides will be parallel to one another; the most convenient both for subdividing and for working in every respect. They always look well, too; awkward acute angles are a nuisance, and look unsightly. Get your right angles, which can be done in a simple manner, then a few straight poles, a good eye and a little patience is all that is required.

Ringbarking.—The forest lands here carrying green timber are naturally sour, and should be ringbarked or otherwise killed, as soon as possible. For large timber sapping has given the best results, contrary to the experience in other districts. Trees thus treated die quickly, and throw less suckers than when ringbarked. In sapping the bark and sapwood should be cut right through all round, and fully 1 inch of the red wood shown. In ringbarking at least 9 inches of the bark should be stripped off, leaving the wood perfectly clean; this is the best system for all young timber, which, if sapped, would be apt to fall. It is advisable to ringbark or sap all timber close to the ground, in order that if suckers grow sheep can reach the young shoots and probably kill a large number, thus providing some feed if grass is scarce at the time, and saving much labour, as suckers must be kept down, or a worse scrub will result than before the trees were touched.

(*To be continued.*)

Weeds of Bathurst District.

[Continued from page 476.]

R. W. PEACOCK.

Bathurst Burr.

[Botanical name, *Xanthium spinosum*, Linn. Introduced from South America.]

THIS is one of the most obnoxious weeds against which incessant war has been waged by pastoralists and farmers, since its introduction. Stock do not eat it. It is extremely hardy, and has adapted itself to all phases of Australian conditions.

The hooked fruits ensure its distribution most thoroughly, they being conveyed by the coverings of all live stock. Wool is most seriously damaged by it, and thousands of pounds have been spent in keeping it in check.

Agriculturally, it affects the summer crops, such as maize, potatoes, &c.

It grows most profusely upon waste-places, banks of streams, &c., and in such situations should be cut before the seeds mature. If cut when the seeds are ripe the plants should be gathered together and burnt.

Clean cultivation of summer crops will eradicate it. Upon lands over-run with them a winter cereal crop should be grown, as the occupation of the land by such prevents the seedlings getting a stand. Such cropping to be followed by a ploughing, as soon as possible after harvest.

Figured in the *Agricultural Gazette*, Vol. 6, Part 7, by Mr. J. H. Maiden, Government Botanist.

Bunt and Seed Wheat.

Standard samples of bunted wheat have been prepared at the Bathurst Experimental Farm, and have been tested by the centrifuge, with interesting results. The sample, prepared by adding to some clean sheaves a known quantity of bunted plants, shows the amount of bunt that may be expected to cling to wheat grains when threshed in the usual manner. An examination of an ordinary sample of seed wheat as threshed at the Bathurst Farm proved the sample to be practically free from bunt, notwithstanding the delicacy of the test applied, namely, the centrifuge test. The detailed results of the examination will be published in a future issue.

Bathurst Burr.

Wild Melon.

[Botanical name.—*Cucumis myriocarpus*, Naud.]

This weed is becoming prevalent throughout this district, the dry weather of the last few years favouring it. It is extremely hardy and drought-resistant, and thrives under very inhospitable conditions in the far west of the State, where it has been credited with causing blindness amongst horses. Stock are not fond of it, but under some conditions eat the fruits, which to some extent resemble gherkins.

The fruits are small, and produced in great profusion. The vines run for several yards, and when dead leave many hundreds of ripe melons to perpetuate the nuisance.

Agriculturally, it too, affects the summer crops, and should be cut with hoe or cultivator, before the seeds mature

Vigorous measures should be taken to eradicate it before it gains too great a hold.

Oats grown at Bathurst Experimental Farm, 1904.

R. W. PEACOCK.

Variety.	Paddock.	Area.	Date sown.	Seed per acre.	Date harvested.	Yield per acre.	Rainfall during growth.	Remarks.
	No.	a. r. p.		lb.		bushels.	in.	
Algerian ...	5	0 2 0	9 June	55	6 Dec..	34½		
Carter's Royal Cluster.	5	2 0 0	7 ,,	45	14 ,,	19½		
Peerless White Bonanza.	5	1 3 14	7 ,,	43	14 ,,	22		
Potato	5	1 0 0	8 ,,	46	14 ,,	21	9·35	Comparable.
Abundance ...	5	2 0 0	8 ,,	41	7 ,,	Cut for hay		
Tartar King ..	5	1 0 0	8 ,,	46½	7 ,,	,, ...		
American Banner .	5	0 2 0	8 ,,	42	7 ,,	,, ...		
Waverley... ...	5	0 2 0	9 ,,	39	7 ,,	,, ...		
Algerian	10	12 1 0	26 May.	...	17 Oct..	t. cwt. 1 5 hay	6·19	
Red Rust Proof ...	10	1 0 0	25 ,,	...	28 ,,	bushels. 26	7·39	

The season, being a comparatively dry one, was unfavourable for oats, and light yields were harvested. The first eight varieties are comparable, and those which were cut for hay were not left for grain, on account of their being seriously affected by the dry weather. The first four varieties withstood the dry weather better.

The oats in Paddock 10 did very well under the conditions, and the Algerian, although cut for hay, would have given comparatively good returns for grain.

The results have again demonstrated the value of the earlier varities, when the spring and summer prove unfavourable.

Algerian and Red Rust Proof, during such seasons, consistently give heavier yields.

Wild Melon.
(Cucumis-myriocarpu

Diseases of the Horse.

In the June and July issues of last year of the *Gazette*, extracts were given from a paper (by Mr. Ch. B. Michner, V.S.) appearing in "The Special Report on Diseases of the Horse," published by the United States Department of Agriculture. The subjects treated on in the June issue were the symptoms and treatment of stomach disorders and diseases of the horse; in July, Foods—Preparation of foods and water. It is not to be expected that in making a few extracts from a lengthy article, justice can be done to the subject. However, such portions have been selected that are considered of the greatest service to farmers and others, far removed from veterinary assistance. The paper from which these extracts are taken was prepared by Mr. W. H. Harbaugh, V.S., and revised up to 1903 by Mr. Leonard Pearson, B.S., V.M.D., and deals entirely with diseases of the respiratory organs.

Causes of Diseases of Respiratory Organs.

The causes of many of the diseases of these organs may be given under a common head, because even a simple cold, if neglected or badly treated, may run into the most complicated lung disease and terminate fatally. In the spring and fall, when the animals are changing their coats, there is a marked predisposition to contract disease, and consequently care should be taken at those periods to prevent other exciting causes.

Badly ventilated stables are a frequent source of disease. It is a mistake to think that country stables necessarily have purer air than city stables. Stables on some farms are so faultily constructed that it is almost impossible for the foul air to gain an exit. All stables should have a sufficient supply of pure air, and be so arranged that strong drafts cannot blow directly on the animals. In ventilating a stable, it is best to arrange to remove air from near the floor and admit it through numerous small openings near the ceiling. The reason for this is that the coldest and most impure air in the stable is near the floor while that which is warmest and purest, and, therefore, can least be spared is near the top of the room In summer, top exits and cross currents should be provided to remove excessive heat. Hot stables are almost always poorly ventilated, and the hot stable is a cause of disease on account of the extreme change of temperature that a horse is liable to when taken out, and extreme changes of temperature are to be avoided as certain causes of disease.

A cold, close stable is invariably damp, and is to be avoided as much as the hot, close, and foul stable. Horses changed from a cold to a warm stable are more liable to contract cold than when changed from a warm to a cold stable. Pure air is more essential than warmth, and this fact should be especially remembered when the stable is made

close and foul to gain the warmth. It is more economical to keep the horse warm with blankets than to prevent the ingress of pure air in order to make the stable warm.

Stables should be well drained and kept clean. Some farmers allow large quantities of manure to accumulate in the stable. This is a pernicious practice, as the decomposing organic matter evolves gases that are predisposing or exciting causes of disease. When a horse is overheated it is not safe to allow him to dry by evaporation; rubbing him dry and gradually cooling him out is the wisest treatment. When a horse is hot—covered with sweat—it is dangerous to allow him to stand in a draught; it is the best plan to walk him until his temperature moderates. In such cases a light blanket thrown over the animal may prevent a cold. Overwork or over-exertion often causes the most fatal cases of congestion of the lungs. Avoid prolonged or fast work when the horse is out of condition or unaccustomed to it. Animals that have been working out in cold rains should be dried and cooled out and not left to dry by evaporation. When the temperature of the weather is at the extreme, either of heat or cold, diseases of the organs of respiration are most frequent.

It is not to be supposed that farmers can give their horses the particular attention given to valuable racing and pleasure horses, but they can most assuredly give them common-sense care, and this will often save the life of a valuable animal. If the owner properly considers his interests he will study the welfare of his horses so that he may be able to instruct the servant in details of stable management.

Wounds about the Nostrils.

Wounds in this neighbourhood are common, and are generally caused by snagging on a nail or splinter or by the bite of another horse; or by getting "run into," or by running against something. Occasionally the nostril is so badly torn and lacerated that it is impossible to effect a cure without leaving the animal blemished for life, but in the majority of instances the blemish, or scar, is due to the want of conservative treatment. As soon as possible after the accident the parts should be brought together and held there by stitches. If too much time is allowed to elapse, the swelling of the parts will considerably interfere. Never cut away any skin that may be loose and hanging, or else a scar will certainly remain. Bring the parts in direct apposition and place the stitches from a quarter to a half inch apart, as circumstances may demand. It is not necessary to have special surgeons' silk and needles for this operation; good linen thread or ordinary silk thread will answer. The wound afterwards only requires to be kept clean. For this purpose it should be cleansed and discharges washed away daily with a solution made of carbolic acid 1 part, in water 40 parts. If the horse is inclined to rub the wound against some object on account of the irritability, his head should be tied by means of two halter ropes attached to the opposite sides of the stall to prevent him rubbing the wound open. The head should be so tied about ten days, except when at work or eating.

Cold in the Head, or Nasal Catarrh.

Catarrh is an inflammation of a mucous membrane. It is accompanied by excessive secretion. In nasal catarrh the inflammation may extend from the membrane lining the nose to the throat, the inside of the sinuses, and to the eyes. It is especially common in young horses and in horses not acclimated.

Symptoms.

The membrane at the beginning of the attack is dry, congested, and irritable; it is of a deeper hue than natural, pinkish red or red. Soon a watery discharge from the nostrils makes its appearance; the eyes may also be more or less affected and tears flow over the cheeks. The animal has some fever, which may be easily detected by means of a clinical thermometer inserted in the rectum or, roughly, by placing the finger in the mouth, as the feeling of heat conveyed to the finger will be greater than natural.

To become somewhat expert in ascertaining the changes of temperature in the horse it is only necessary to place the finger often in the mouths of horses known to be healthy. After you have become accustomed to the warmth of the mouth of the healthy animal you will have no difficulty in detecting a marked increase of the temperature. The animal may be dull; he sneezes or snorts, but does not cough unless the throat is affected; he expels the air forcibly through his nostrils, very often in a manner that may be aptly called "blowing his nose." A few days after the attack begins the discharge from the nostrils changes from a watery to that of a thick, mucilaginous state, of a yellowish white colour, and may be more or less profuse. Often the appetite is lost and the animal becomes debilitated.

Treatment.

This disease is not serious, but inasmuch as neglect or bad treatment may cause it to lead to something worse or become chronic, it should receive proper attention. The animal should not be worked for a time. A few days of quiet rest, with pure air and good food, will be of greater benefit than most medication. The value of pure air can not be over-estimated, but drafts must be avoided. The benefit derived from the inhalation of steam is considerable. This is effected by holding the horse's head over a bucketful of boiling water, so that the animal will be compellod to inhale steam with every inhalation of air. Stirring the hot water with a wisp of hay causes the steam to arise in greater abundance. One may cause the horse to put his nose in a bag containing cut hay upon which hot water has been poured, the bottom of the bag being stood in a bucket, but the bag must be of loose texture, as gunny sack, or, if of canvas, holes must be cut in the side to admit fresh air.

The horse may be made to inhale steam four or five times a day, about fifteen or twenty minutes each time.

Particular attention should be paid to the diet. Give bran mashes, scalded oats, linseed gruel, and grass, if in season. If the horse evinces

no desire for this soft diet, it is better to allow any kind of food he will eat, such as hay, oats, corn, etc., than to keep him on short rations.

If the animal is constipated, relieve this symptom by injections (enemas) of warm water into the rectum three or four times a day, but do not administer purgative medicines, excepting of a mild character.

For simple cases the foregoing is all that is required, but if the appetite is lost and the animal appears debilitated and dull, give 3 ounces of the solution of acetate of ammonia and 2 drams of powdered chlorate of potassium diluted with a pint of water three times a day as a drench. Be careful when giving the drench; do not pound the horse on the gullet to make him swallow; be patient, and take time, and do it right.

If the weather be cold, blanket the animal and keep him in a comfortable stall. If the throat is sore, treat as advised for that ailment, to be described hereafter.

If, after ten days or two weeks, the discharge from the nostrils continues, give one-half dram of reduced iron three times a day. This may be mixed with damp feed. Common cold should be thoroughly understood and intelligently treated in order to prevent more dangerous diseases.

Chronic Catarrh (or Nasal Gleet, or Collection in the Sinuses).

This is a subacute or chronic inflammation of some part of the membrane affected in common cold, the disease just described. It is manifested by a persistent discharge of a thick white or yellowish white matter from one or both nostrils. The commonest cause is a neglected or badly treated cold, and it usually follows those cases where the horse has suffered exposure, been overworked, or has not received proper food, and, as a consequence, has become debilitated.

Other but less frequent causes for this affection are: Fractures of the bones that involve the membrane of the sinuses, and even blows on the head over the sinuses. Diseased teeth often involve a sinus and cause a fetid discharge from the nostril. Violent coughing is said to have forced particles of food into the sinus, which acted as a cause of the disease. Tumors growing in the sinuses are known to have caused it. It is also attributed to disease of the turbinated bones. Absorption of the bones forming the walls of the sinuses has been caused by the pressure of pus collecting in them and by tumors filling up the cavity.

Symptoms.

Great caution must be exercised when examining these cases, for the horse may have glanders, while, on the other hand, horses have been condemned as glandered when really there was nothing ailing them but nasal gleet. This affection is not contagious. It may stubbornly resist treatment and last for a long time. In most cases the discharge is from one nostril only, which may signify that the sinuses on that side of the head are affected. The discharge may be

intermittent, that is, quantities may be discharged at times and again little or none for a day or so. Such an intermittent discharge usually signifies disease of the sinuses. The glands under and between the bones of the lower jaw may be enlarged. The peculiar ragged-edged ulcer of glanders is not to be found on the membrane within the nostrils, but occasionally sores are to be seen there. If there is any doubt about it, study well the symptoms of glanders to enable you to be at least competent to form a safe opinion.

The eye on the side of the discharging nostril may have a peculiar appearance and look smaller than its fellow. There may be an enlargement, having the appearance of a bulging out of the bone over the part affected, between or below the eyes. The breath may be offensive, which indicates decomposition of the matter or bones, or disease of the teeth. A diseased tooth is further indicated by the horse holding his head to one side when eating, or by dropping the food from the mouth after partly chewing it. When you tap on the bones between the eyes, below the eyes, and above the back teeth of the upper jaw, a hollow, drum-like sound is emitted, but if the sinus is filled with pus or contains a large tumor the sound emitted will be the same as if a solid substance were struck; by this means the sinus affected may be located in some instances. The hair may be rough over the affected part, or even the bone may be soft to the touch and the part give somewhat to pressure or leave an impression where it is pressed upon with the finger.

Treatment.

The cause of the trouble must be ascertained before treatment is commenced. In the many cases where the animal is in poor condition (in fact, in all cases) he should have the most nutritive food and regular exercise. The food, or box containing it, should be placed on the ground, as the dependent position of the head favours the discharge.

The cases that do not require a surgical operation must, as a rule, have persistent medical treatment. Mineral tonics and local medication are of the most value. For eight days give the following mixture: Reduced iron, 3 ounces; powdered nux vomica, 1 ounce. Mix and make into sixteen powders. Give one powder mixed with the food twice a day. Arsenious acid (white arsenic) in doses of from 3 to 6 grains three times daily is a good tonic for such cases. Sulphur burnt in the stable while the animal is there to inhale its fumes is also a valuable adjunct. Care should be taken that the fumes of the burning sulphur are sufficiently diluted with air, so as not to suffocate the horse. Chloride of lime sprinkled around the stall is good. Also keep a quantity of the chloride under the hay in the manger, so that the gases will be inhaled as the horse holds his head over the hay while eating. Keep the nostrils washed, and keep the discharge cleaned away from the manger and stall. The horse may be caused to inhale creoline vapour or the vapour of compound tincture of benzoin by pouring 2 ounces of these drugs into hot water and fumigating in the usual way.

Thickening of the Membrane.

This is sometimes denoted by a chronic discharge, a snuffling in the breathing, and a contraction of the nostril. It is a result of common cold and requires the same treatment as prescribed for nasal gleet, namely, the sulphate of iron, sulphate of copper, iodide of potassium, &c. The membranes of both sides may be affected, but one side only is the rule; and the affected side may be easily detected by holding the hand tightly over one nostril at a time. When the healthy side is closed in this manner, the breathing through the affected side will demonstrate a decreased calibre or an obstruction.

Sore Throat, or Laryngitis.

The larynx is situated in the space between the lower jawbones, just back of the root of the tongue. It may be considered as a box (somewhat depressed on each side), composed principally of cartilages and small muscles, and lined on the inside with a continuation of the respiratory mucous membrane. Posteriorly it opens into and is continuous with the windpipe. It is the organ of the voice, the vocal cords being situated within it; but in the horse this function is of little consequence. It dilates and contracts to a certain extent, thus regulating the volume of air passing through it. The mucous membrane lining it internally is so highly sensitive that if the smallest particle of food happens to drop into it from the pharynx violent coughing ensues instantly, and is continued until the source of irritation is ejected. This is a provision of nature to prevent foreign substances gaining access to the lungs. That projection called Adam's apple in the neck of man is the prominent part of one of the cartilages forming the larynx.

Inflammation of the larynx is a serious and sometimes a fatal disease, and is usually complicated with inflammation of the pharynx, constituting what is popularly known as "sore throat." The chief causes are chilling and exposure.

Symptoms.

About the first symptom noticed is cough, followed by difficulty in swallowing, which may be due to soreness of the membrane of the pharynx, over which the food or water must pass, or to the pain caused by the contraction of the muscles necessary to impel the food or water onward to the gullet; or this same contraction of the muscles may cause a pressure on the larynx and produce pain. In many instances the difficulty in swallowing is so great that water, and in some cases food, is returned through the nose. This, however, does not occur from laryngitis alone, but only when the pharynx is involved in the inflammation. The glands between the lower jawbones and below the ears may be swollen. Pressure on the larynx induces coughing. The head is more or less "poked out," and has the appearance of being stiffly carried. The membrane in the nose becomes red. A discharge from the nostrils soon appears. As the

disease advances, the breathing may assume a more or less noisy character; sometimes a harsh rasping snore is emitted with every respiration, the breathing becomes hurried, and occasionally the animal seems threatened with suffocation.

Treatment.

In all cases steam the nostrils, as has been advised for cold in the head. In bad cases cause the steam to be inhaled continuously for hours—until relief is afforded. Have a fresh bucketful of boiling water every fifteen or twenty minutes. In each bucketful of water put a tablespoonful of oil of turpentine, or compound tincture of benzoin, the vapour of which will be carried along with the steam to the affected parts and have a beneficial effect. In mild cases steaming the nostrils five, six, or seven times a day will suffice.

The animal should be placed in a comfortable, dry stall (a box stall preferred), and should have a pure atmosphere to breathe. The body should be blanketed, and bandages applied to the legs. The diet should consist of soft food—bran mashes, scalded oats, linseed gruel, and, best of all, grass, if in season, which should be fresh. The manger, or trough, should not be too high nor too low, but a temporary one should be constructed at about the height he carries his head. Having to reach too high or too low may cause so much pain that the animal would rather forego satisfying what little appetite he might have than inflict pain by craning his head for food or water. A supply of fresh water should be before him all the time; he will not drink too much, nor will the cold water hurt him. Constipation (if present) must be relieved by enemas of warm water, administered three or four times during the twenty-four hours.

A liniment composed of 2 ounces of olive oil and 1 ounce each of solution of ammonia and tincture of cantharides, well shaken together, may be thoroughly rubbed in about the throat from ear to ear, and about six inches down over the windpipe, and in the space between the lower jaws. This liniment should be applied once a day for two or three days.

If the animal is breathing with great difficulty, persevere in steaming the nostrils, and dissolve 2 drams of chlorate of potatsium in every gallon of water he will drink; even if he cannot swallow much of it, and even if it is returned through the nostrils, it will be of some benefit to the pharynx as a gargle.

An electuary of acetate of potash, 2 drams, honey, and licorice powder may be spread on the teeth with a paddle every few hours. If the pain of coughing is great, 2 or 3 grains of morphine may be added to the electuary.

When the breathing begins to be loud relief is afforded in some cases by giving a drench composed of 2 drams of fluid extract of jaborandi in half a pint of water. If benefit is derived, this drench may be repeated four or five hours after the first dose is given. It will cause a free flow of saliva from the mouth.

In urgent cases, when suffocation seems inevitable, the operation of tracheotomy must be performed. To describe this operation in words

that would make it comprehensible to the general reader is a more difficult task than performing the operation, which, in the hands of the expert, is simple and attended with little danger.

If abscesses form in connection with the disease they must be opened to allow the escape of pus, but do not rashly plunge a knife into swollen glands; wait until you are certain the swelling contains pus. The formation of pus may be encouraged by the constant application of poultices for hours at a time. The best poultice for the purpose is made of linseed meal, with sufficient hot water to make a thick paste. If the glands remain swollen for some time after the attack, rub well over them an application of the following: Biniodide of mercury, 1 dram; lard, 1 ounce; mix well. This may be applied once every day until the part is blistered.

Sore throat is also a symptom of other diseases, such as influenza, strangles, purpura hemorrhagica, etc., which diseases may be consulted under their proper headings.

After a severe attack of inflammation of the larynx the mucous membrane may be left in a thickened condition, or an ulceration of the part may ensue, either of which are liable to produce a chronic cough. For the ulceration it is useless to prescribe, because it can neither be diagnosed nor topically treated by the non-professional.

If a chronic cough remains after all the other symptoms have disappeared, it is advisable to give 1 dram of iodide of potassium dissolved in a bucketful of drinking water one hour before feeding, three times a day, for a month if necessary. Also rub in well the preparation of iodide of mercury (as advised for the swollen glands) about the throat, from ear to ear, and in the space between the lower jaw bones. The application may be repeated every third day until the part is blistered.

Thick Wind and Roaring.

Horses that are affected with a chronic disease that causes a loud unnatural noise in breathing are said to have thick wind, or to be roarers. This class does not include those affected with severe sore throat, as in these cases the breathing is noisy only during the attack of the acute disease.

Thick wind is caused by an obstruction to the free passage of the air in some part of the respiratory tract. Nasal polypi, thickening of the membrane, pharyngeal polypi, deformed bones, paralysis of the wing of the nostril, &c., are occasional causes. The noisy breathing of horses after having been idle and put to sudden exertion is not due to any disease and is only temporary. Very often a nervous, excitable horse will make a noise for a short time when started off, generally caused by the cramped position in which the head and neck are forced in order to hold him back.

Many other causes may occasion temporary, intermitting, or permanent noisy respiration, but chronic roaring is caused by paralysis of the muscles of the larynx; and almost invariably it is the muscles of the left side of the larynx that are affected.

In chronic roaring there is no evidence of any disease of the larynx other than the wasted condition of the muscles in question. The

disease of the nerve is generally located far from the larynx. Disease of parts contiguous to the nerve along any part of its course may interfere with its proper function. Enlargement of lymphatic glands within the chest through which the nerve passes on its way back to the larynx is the most frequent interruption of nervous supply, and consequently roaring. When roaring becomes confirmed medical treatment is entirely useless, as it is impossible to restore the wasted muscle and at the same time remove the cause of the interruption of the nervous supply. Before roaring becomes permanent the condition may be benefited by a course of iodide of potassium, if caused by disease of the lymphatic glands. Electricity has been used with indifferent success. Blistering or firing over the larynx is, of course, not worthy of trial if the disease is due to interference of the nerve supply. The administration of strychnia (nux vomica) on the ground that it is a nerve tonic with the view of stimulating the affected muscles is treating only the result of the disease without considering the cause, and is therefore useless. The operation of extirpating the collapsed cartilage and vocal cord is believed to be the only relief, and, as this operation is critical and can only be performed by the skilful veterinarian, it will not be described here.

The Parasitic Worm Heterakis Inflexa included in a Fowl's Egg.

N. A. COBB.

THIS note is to record a remarkable inclusion in the egg of the domestic fowl, namely, a full grown specimen of the larger of the two commonest of the intestinal Nematode worms of the fowl.

An egg on being broken open for domestic use was noticed to contain a wormlike body. The attention of competent authority was at once called to the matter, and the specimen was placed in spirit for examination. On investigation the specimen was found to be a full grown male of the Nematode worm *Heterakis inflexa* (Rudolphi).

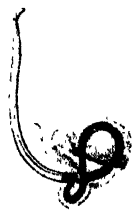


Fig. 1.—Life size figure of a male worm of the species *Heterakis inflexa*, found included in the egg of a healthy domestic fowl. The posterior part of the worm was embedded in the more solid part of the white of the egg.

The egg from which this worm was removed was about a week old, and the fowl from which it originated is known. The fowl was in good condition, showing no signs of ill health of any sort.

The worm was in a very good state of preservation, though it appeared to be dead, no motion being observable. The egg appeared to be all right except for the presence of the worm. On examination the worm showed no signs of maceration.

To account for the presence of this worm in the egg of the fowl we are driven to theorise. The most plausible supposition is that immediately after the previous egg was laid the living and active worm, being already at the terminus of the intestine, wandered into the egg sack, and thus became included in the succeeding egg. It is known that the fowl was laying regularly at the time.

It may be taken for granted that the worm did not perforate the intestine, and bore its way into the egg sack, as this would almost surely have resulted in peritonitis and death. On one occasion I have had opportunity to examine a perforation of this sort, though the worms did not enter any other organ. The observation was made on a specimen that had died a natural death, that result being attributed to the perforation, and resulting peritonitis. It would seem as if this parasite could hardly perforate the intestine without causing death.

There are one or two other suppositions that might possibly be entertained, in order to account for the presence of *Heterakis inflexa* in a fowl's egg, but they involve such remote possibilities that they may be neglected.

I will here mention another alleged inclusion that has come under my notice. A servant brought to me a broken egg with the remains of a spider in it. The spider was not complete, and had a peculiar transparent look as if it had been soaked for some time, or possibly as if it had been only a cast off skin. The occurrence was so remarkable that I came to the conclusion that possibly the spider might have dropped into the basin when the servant was not looking, and thus have deceived her. However, while she could not aver that she had seen the spider actually come from the egg as she broke it, she was firmly of the opinion that it was derived from the interior of the egg. She was a very trustworthy person, but I have always remained in doubt as to whether that fragment of a spider had neatly been included in the egg.

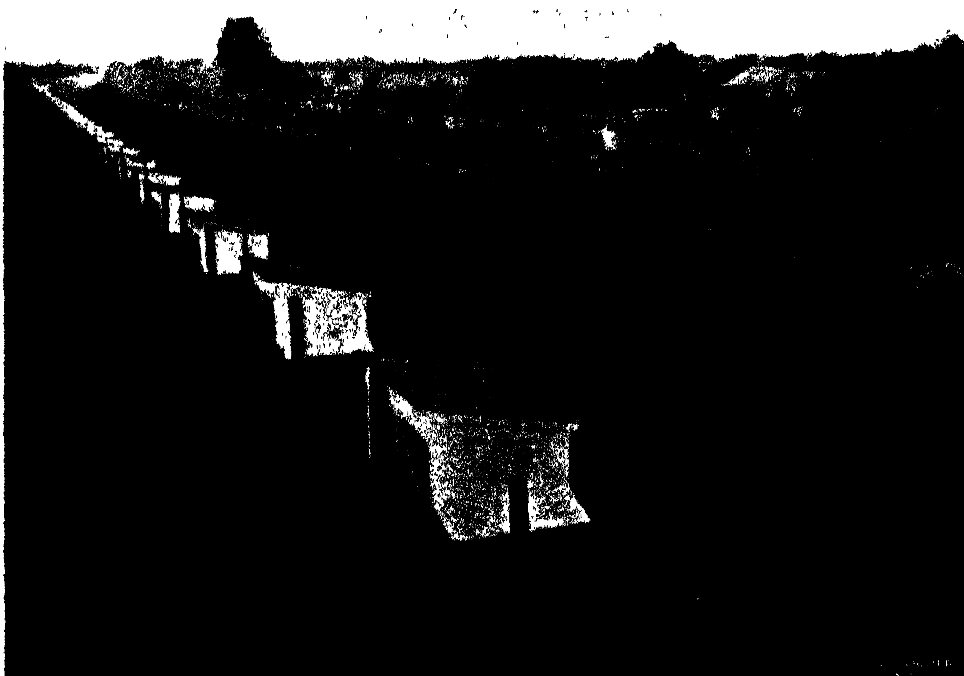
The inclusion of an entirely external object, such as a fragment of a spider would be quite as remarkable as the inclusion of a parasite of the fowl itself, and would compel us to admit the possibility of a fowl seriously contaminating her egg sack while depositing her egg.

Hawkesbury Agricultural College and Experimental Farm.

Third Annual International Egg-laying Competition—Winter and Summer Test—April, 1904, to March, 1905.

D. S. THOMPSON,
Poultry Expert, Hawkesbury Agricultural College.

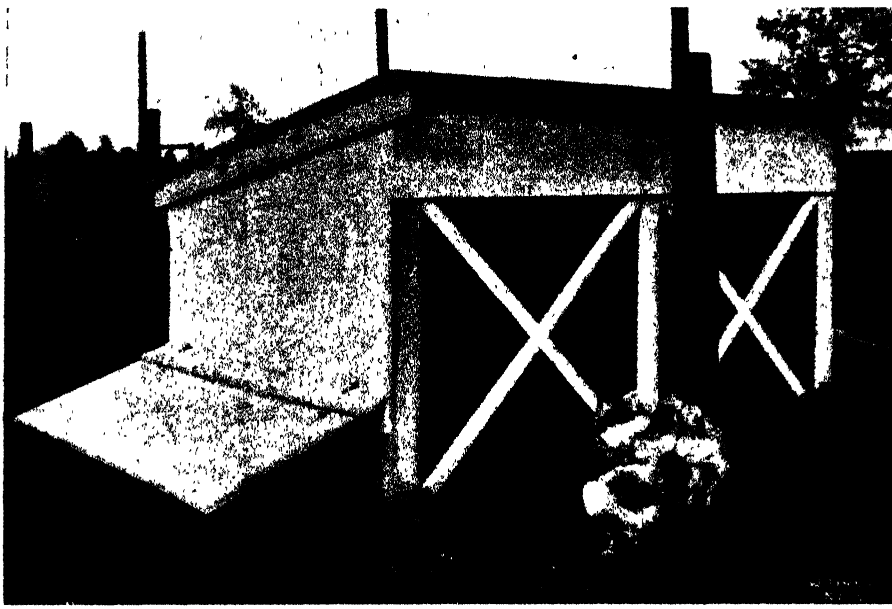
The Egg-laying Competition for 1904–5 will always be looked upon as a memorable one. Not in the fact of it being ahead of previous competitions in the matter of results, but as the last "International Competition" which possibly may ever take place.



General view of Competition Pens.

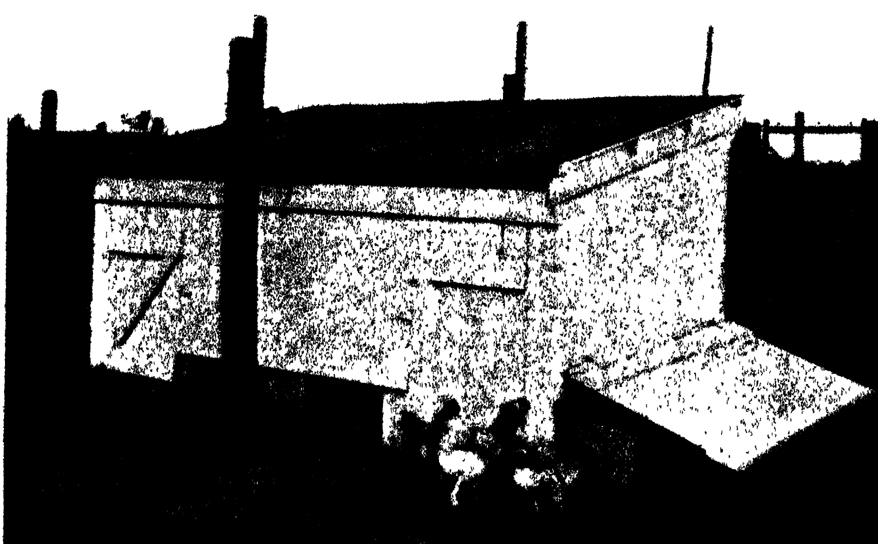
Besides the States of New South Wales, Victoria, and Queensland, New Zealand was represented by two pens, and America by no less than seven pens. The interest centred in these Egg-laying Competitions has been very keen and world-wide, and to-day they are more popular than ever. Every State in Australia, and also New Zealand, has either already initiated an Egg-laying Competition, or is now busy making preparations for starting one.

There have been several Egg-laying Competitions in England, but they have been merely for the one purpose of demonstrating "How to make hens lay



Front view of one of the Egg-laying Competition Double Houses.

during the winter months, and what breeds would give the best results under winter conditions." In America, the great land of utility poultry farming, strange to relate, there have never been any Egg-laying Competitions.



Back view of same (nest box under flap).

Although such has been the case, nevertheless the Americans have been more keenly interested in our work than any other country. Their press has given

our work great publicity, one or two references from the many notices appearing in the leading poultry papers will show this.

Thus *Commercial Poultry* (Chicago).—"The Australian Egg-laying Competition is creating national interest. The daily Press will keep the readers of daily papers fully informed from time to time, arrangements having been made in this office to furnish the latest reports as the contest progresses. The competition means more for the foreign trade of American poultrymen than anything that has ever been inaugurated to spread the fame of the American hen."

And *Farm Poultry* (Boston), says:—"American poultry-keepers do not appreciate how far behind English and Australian poultry-keepers they are in the matter of co-operation. That is the weak point in our system—if we may call that a system which is made up of little things without unity. There seems to be just enough of the quality of selfish indifference in our individuality to keep us from getting together in competitions like that in Australia. Besides our competitions in poultry have all gone in the line of competition in fancy points, until a great many think competition in practical things is impossible."

Feeding.

Feeding will always be the most important subject in relation to egg-production Suitable foods, properly fed will give a profit, while wrong foods wrongly fed will just as assuredly give a loss.

For 1903-4 maize was fed very largely, and gave excellent results, the average laying for each hen being 163 eggs.

For 1904-5 very little maize was fed, and the results were not so good, the average being 152 eggs per hen; but 600 hens were carried against 425, and the weather conditions were much more adverse, both of which were strong reasons for this decline. While there is no wish to put the shortage down to wheat, there are still strong reasons to believe that maize can be fed to poultry for profitable egg-production. The feeding of poultry on maize was only undertaken in these competitions after mature thought, and results have amply demonstrated that maize is a splendid food for poultry. As both Argentine and New South Wales grown maize were used, and in order that no doubt can exist as to their relative feeding value, the analyses of the two corns, by Messrs. F. B. Guthrie and A. A. Ramsay, chemists to the Department of Agriculture, are given as follows:—

	Bulk Argentine Maize.	N.S.W. Northern River Maize.
Moisture	12·07	11·36
Albuminoids	10·13	10·06
Ether extract (fat and oil)	4·47	4·57
Fibre	1·54	1·53
Ash	1·35	1·32
Carbohydrates	70·44	71·16
Nutrient value	90·6	91·5
Albuminoid ratio	1 to 8	1 to 8

This table shows distinctly the same albuminoid ratio and only a slight percentage of oil and fat in excess in Australian-grown corn. Argentine corn appears from the analyses to be the better, but the composite difference is not great enough to discard the use of Australian-grown corn.

Egg-laying Capacity and Breed.

The egg-laying capacity of the various varieties and breeds is the next very important point for demonstration in Egg-laying Competitions. There are many who affirm that this can never be demonstrated; but against this, the fact that the majority of poultry-men agree that breed does count is shown by their support of Silver Wyandottes, Black Orpingtons, and White Leghorns. There are some who say, "Never mind the breed, pick a good strain," while our advice is, select the best breed possible and then select the best strain of that breed. The best breed is the one which is most prolific, easy to hatch, hardy, will lay a good marketable egg, lay in the winter time, and lay the greatest number of eggs in twelve months, and then sell well for the table. The Egg-laying Competitions have amply demonstrated that Silver Wyandottes and Black Orpingtons fill the bill.

An Experiment with Paspalum dilatatum.

The Principal of the College, Mr. H. W. Potts, caused some 600 plants of *Paspalum dilatatum* to be placed in the Egg-laying Competition pens for the purpose of experiment. The plants rooted and grew well, but not to a great height, which was all the better for this experiment. Throughout the twelve months it was found that while the *Paspalum* was nice and green and apparently succulent, the hens never attempted to eat it so long as they could get plenty of sweet couch grass (*Cynodon dactylon*), which is no doubt the favourite grass of poultry.

The American Pens.

The Americans sent us some untried varieties, viz., the Silver-pencilled Wyandotte, the White Rock, also the Rose-comb White Leghorn and the Rose-comb Brown Leghorn, as well as the Rhode Island Reds. Silver-laced and Golden-laced Wyandottes were not represented in the American pens; why these established breeds were not represented is not known. Surely both would have given a much better performance than the Silver-pencilled Wyandotte or the White Rock. It is the experience here, and it must be that of all who have either made a breed or who have persistently tried to develop one, that the stamina is almost lost before a type can be successfully formed and the colour fixed. Considering the varieties that were sent, the American hens acquitted themselves with honor.

The following is the official list of the committee of management of the competition and the rules under which it was run:—

THIRD ANNUAL INTERNATIONAL TEST, 1904-5.

Committee of Management:—Mr. W. S. Campbell (Director of Agriculture), Mr. H. W. Potts (Principal, H. A. College), Mr. D. S. Thompson (Poultry Expert, H. A. College), Mr. A. A. Dunnicliff, jun. (*The Daily Telegraph*); Messrs. W. Harris, A. E. Henry, F. L. Martin, E. Waldron, and M. Ward (competitors' representative).

Competition Rules.

1. The competition to extend over the period from 1st April, 1904, to 31st March, 1905, inclusive; competitors to deliver their birds at the Hawkesbury Agricultural College between 1st and 24th March inclusive.
2. Each pen to consist of six pure-bred pullets, not less than seven months or more than twelve months old on 1st April, 1904. No male bird to be included.
3. All birds to be bred by and to be the property of the competitor.
4. The birds upon being accepted by the poultry expert when delivered at the College, as being of suitable age, no protest will be entertained upon that point.
5. Any bird found to be suffering from an infectious or contagious disease when delivered at the College to be rejected, and replaced by the competitor.
6. The poultry expert is empowered to reject any bird that is not a fair specimen of the breed entered, such bird to be replaced.
7. One wing of each pullet to be cut by the owner before forwarding to the College. The wing to be kept cut during the currency of the competition.
8. In the event of a bird dying, becoming diseased, or incapacitated from laying, the competitor to be allowed to replace it with another of the same age and breed.
9. All eggs to become the property of the Department of Agriculture.
10. The competition to be decided by the total number of eggs laid by each pen.
11. Eggs under 1½ oz. in weight, or otherwise unmarketable, not to be counted
12. Any pen, the eggs from which do not attain an average weight of 21 oz. per dozen after the first three months of the competition, to be ineligible for a prize.
13. The market value of the eggs from each pen to be recorded, and prizes given for the greatest total value.
14. Prizes to be given for a winter test, to extend over the first four months of the competition, and to be restricted to Australasian competitors.
15. Records to be kept of the total quantities of the various foods consumed, and the average cost per head.
16. No competitor to be allowed to withdraw any bird until the termination of the competition.
17. The Committee's decision in all matters of dispute to be final.

The following is a *résumé* of the General Report appearing in the *Daily Telegraph*, 1st April, 1905:—

EGG-LAYING COMPETITION AT HAWKESBURY COLLEGE.

THIRD ANNUAL TEST—GOOD RESULTS UNDER ADVERSE CONDITIONS—PROFIT OF £248 ON 600 HENS.

THE third annual international Egg-laying Competition, organised by the *Daily Telegraph*, and conducted at the Hawkesbury Agricultural College by Mr. D. S. Thompson, Government Poultry Expert, terminated yesterday.

The results achieved are, perhaps, of more practical service as an object lesson in the egg-production branch of the poultry industry than were the more brilliant doings of the previous year. They demonstrate that under really adverse conditions good payable egg-production can be secured. Such experiences are all evidence of the stability and possibilities of poultry-farming rightly conducted, and bring out the fact that a "lean year" can nevertheless be made a profitable one. The 600 hens showed a profit of £248 over the cost of feed. The attention demanded by this number of hens does not fully represent one man's work.

The falling off in the average egg yield for this competition as compared with the records for the previous test, is simply a reflex of the difference in the weather conditions. In this respect Mr. Thompson was able to report of the 1903–4 competition: "The weather throughout was favourable to a good production of eggs. There was plenty of rain, but it was periodic. At no time did we have a spell of wet weather sufficiently long to interfere materially with the laying. The winter months were rather dry, frosty, and cold; and as these frosts were followed by a fairly long period of damp, dull, cold weather well into the spring, the climatic conditions were undoubtedly in favour of the Asiatic varieties and adverse to the Mediterraneans." As will be seen below, the conditions were entirely reversed during the competition year just closed.

The competition was carried out on the most practical lines. The hens got the simple everyday treatment such as the poultry-keeper who had to make his living out of his birds could give. There was no fancy feed, but just the plain, wholesome diet that is available to anyone in the land. But, of course, the experience and constant observation of the management played an important part in tempting the layers to do their best under the circumstances. The influence and usefulness of such tests does not begin and end with the breeders immediately concerned. The main object of the promoters is

to stimulate systematic breeding for egg-production, and in this respect the influence of the competitions has extended far and near throughout Australasia, and even beyond. Where there was one poultry-keeper two or three years ago who made egg-production a definite object by breeding from tested layers, there are now hundreds doing so. And this army of practical workers in the most important branch of utility poultry-culture is rapidly gaining zealous recruits, whose common objective is to breed fowls of a higher and higher standard of productiveness. It is not too much to say that their efforts in this direction are becoming an object lesson to the world.

The widespread interest in the competition was to some extent evidenced by the thousands of visitors who inspected the pens during the year. These not only came from all parts of the Commonwealth, but there were also visitors from New Zealand, America, Canada, England, South Africa, and Japan. In Mr. Thompson's opinion, "there is no doubt that this interest which the competitions are causing will be to the advancement of the poultry industry."

The Prize Winners.

The prize money amounted to £140, and was won as follows:—

For the greatest number of eggs in the twelve months:—

	£	s.	d.
1. G. Howell	15	0	0
2. J. Lowe...	11	0	0
3. J. M. Anderson ...	8	0	0
4. F. J. Brierley	7	0	0
5. Mrs. E. Scaysbrook ...	6	0	0
6. S. Ellis	5	0	0
7. V. J. Zahel	4	10	0
8. A. J. Byrne	4	0	0
9. Oceanside Poultry Farm	3	10	0
10. W. H. Peters	3	0	0
11. J. Potts and Mrs. J. J. Roche (equal) each ...	2	5	0
13. Royle Poultry Farm ...	1	10	0
14. C. Bridekirk	1	0	0
15 F. J. Powney	1	0	0
16. Mrs. A. H. Hansel ...	1	0	0
17. W. Cook	1	0	0
18. Dr. J. Martin	1	0	0
19. W. Wild	1	0	0
20. A. Wedlich	1	0	0

For the winter test (first four months):—

	£	s.	d.
1. G. Howell	5	0	0
2. W. H. Peters	4	0	0
3. Mrs. E. Scaysbrook ..	3	0	0
4. Royle Poultry Farm and C. H. Wickham (equal) each	2	5	0
6. D. J. Stephens	1	10	0
7. E. Solomon	1	0	0
8. W. H. Tombs	0	10	0
9. Mrs. N. Kirby	0	10	0

For the market value of eggs in the twelve months:—

	£	s.	d.
1. G. Howell and J. M. Anderson (equal) each	3	10	0
3. Mrs. E. Scaysbrook ...	2	10	0
4. J. Lowe...	2	0	0
5 W. H. Peters	1	10	0
6. Mrs. A. H. Hansel ...	1	0	0
7. Royle Poultry Farm ...	0	10	0
8. F. J. Brierley	0	10	0

For the last three months (moulting period):—

	£	s.	d.
1. V. J. Zahel, 339 eggs..	3	0	0
2. Mrs. J. J. Roche, 311 eggs	2	0	0
3. Bonaventure Poultry Farm, 308 eggs ...	1	10	0
4. G. Howell, 306 eggs ..	1	0	0
5. J. M. Anderson, 299 eggs	0	10	0

For the first month (open only to Australasian pens laying 70 eggs or more):—

	£	s.	d.
1. J. Gamble	2	0	0
2. G. Howell	1	10	0
3. D. J. Stephens	1	0	0
4. A. J. Byrne	0	10	0

Monthly prize of £1 for the highest total from a pen:—

April, J. Gamble	111 eggs
May, Mrs. A. H. Hansel ...	113 ,,
June, W. H. Peters ...	113 ,,
July, J. B. Smith	125 ,,
August, Mrs. E. Scaysbrook	120 ,,
September, F. J. Brierley	130 ,,
October, F. J. Brierley ...	154 ,,
November, F. J. Brierley ..	153 eggs
December, V. J. Zahel ...	147 ,,
January, A. Arnold... ...	127 ,,
February, Bonaventure Poultry Farm	114 ,,
March, W. Cook	118 ,,

The Turner Trophy, presented by Mr. J. C. Turner for the greatest value of eggs from a New South Wales pen:—

G. Howell.

The Winning Pen.

The chief merit of Mr. George Howell's performance in finishing at the head of the list is that he has considerably improved upon his excellent record in the previous competition, when he beat all the Australian competitors in the six months' winter test. The work of his hens was marked more by consistency than by brilliancy. They laid well from start to finish, and were never lower than fourth. From third place the first

Winning Pen—Silver-laced Wyandottes.—G. Howell.

month, they went to first in the third, and maintained their lead until the close of the winter test. After easing back in the summer, they headed the list in February, and finished with 31 eggs to spare, and an average of 204 eggs per hen. They leave the College in splendid condition—fit, in fact, to enter another year's ordeal. The hens are of medium size, very active, and moderate eaters.

Comparison of Results.

The most prominent feature of the records is a decline of 11 eggs per hen in the average production, as compared with the preceding test. Considering the great difference in the weather conditions covering the two years, it is a matter for congratulation that the disparity was not much greater. The financial results were affected by the fact that the average price of eggs was 30 per cent. less than for the previous year. As a partial set off against this, however, the cost of feeding was 24 per cent. less. The following compares the results of the three competitions:—

	1902-3.	1903-4.	1904-5.
Number of pens ...	38	70	100
Winning pen's total ...	1,113	1,308	1,224
Lowest pen's total ...	459	666	532
Highest total for a month ...	137	160	154
Average laying per hen ...	130	163	152
Greatest value of eggs ...	£7/0/3	£7/10/4	£5/13/10
Average price of eggs ...	1/1	1/3¾	1/-
Average value of eggs per hen ...	15/6	17/9½	12/9
Cost of feed for hen ...	6/-	5/9¾	4/5¼
Profit over feed per hen ...	9/6	11/11¾	8/3¼

A comparison of the average number of eggs from a pen each month of the three competitions is afforded by the following :—

Month.	First.	Second.	Third.
April ...	18·4	18·3	23·8
May ...	26·5	44·6	33·8
June ...	40·0	69·0	49·0
July ...	68·6	94·6	77·8
August	97·3	122·2	104·2
September	106·3	121·8	102·1
October	97·7	111·9	108·2
November	84·5	94·4	102·6
December	77·4	89·2	94·1
January	78·7	82·9	77·6
February	46·6	72·9	72·3
March	51·0	57·9	65·6

A comparison of the average egg-production and the average value of the eggs per hen of the various breeds is instructive and interesting. As a guide, however, to the relative merits of the different breeds, no significance can be attached to the positions occupied by varieties in which there were only one or two pens competing. The following are the analyses :—

Breed.	Per Hen Eggs.	Per Hen—Value.
6 Rose-comb Brown Leghorns	178·50	16/6
6 Rhode Island Reds	176·00	14/9
96 White Leghorns ...	166·23	13/7
12 Black Hamburgs ...	163·83	13/9
6 Anconas ...	163·66	13/2
12 Rose-comb White Leghorns	163·33	14/6
108 Black Orpingtons ..	159·48	13/8
6 Imperials .	158 16	14/9
12 Buff Wyandottes ...	155·25	14/8
18 Brown Leghorns ...	154·77	11/9
18 Golden Wyandottes	151·55	13/2
36 White Wyandottes	151·02	12/9
18 Buff Leghorns	147·77	12/9
108 Silver Wyandottes	145·30	12 3
60 Buff Orpingtons ...	142·95	12/4
6 Andalusians	142·00	10/10
6 Jubilee Orpingtons	141·33	12/2
6 Pile Leghorns	140·50	12/4
24 Minorcas ...	133·38	10/4
18 Langshans...	131·88	10/4
6 White Rocks	124·00	11/-
12 Partridge Wyandottes ...	107·00	8/6

Mr. Thompson's Review.

"That these competitions are doing a vast amount of good in a variety of ways, reports Mr. Thompson, "is beyond cavil. One direction is in the advancement of early breeding. This does not mean, as some people think, breeding out of season, viz., in April, May, or even June, but simply breeding in season, catching the early spring, and hatching out the great bulk of the stock in early August. How many breeders before these competitions started were breeding in early August, or had the bulk of their stock hatched before the end of September, or even into October, November, and December? Very few would be the reply, and this was proved by the fowls competing in the first Egg-laying Competition, as pretty well the whole of the competing hens were bred out of

season, having been hatched either in April and May, or in November and December. Now there is no difficulty in filling the whole 100 pens with August-bred birds, or, at the latest, September. Who will say that is no gain?

"The whole of the 600 hens entered the test in good health and condition, although a few of them were not quite true to feather of the breeds they represented. Still, even in that way there was a great improvement, and to touch on the next competition, we are pleased to be able to say that in type and colour there is a striking improvement in the pullets that have been sent to us.

The American Pens.

"Six of the seven pens constituting the contingent from America, arrived at the College on December 16. The whole of the pullets were received in very good health. But we have concluded from observation that the pullets arrived too young—that is to say, that the shipment of pullets from a winter to a summer zone is not advisable. The extreme change before the pullets had reached maturity played very heavily upon

Oceanside Poultry Farm, America—White Wyandottes.

them, and it was only with very great care and attention that we got a large percentage of them through the unseasonable moult, and that we were able to pen six of each in good condition. This gave us a demonstration of data of some value, that the older fixed varieties had the greatest stamina, and came through the trying time with the least loss.

The Weather Conditions.

"From the start to the finish the weather conditions were variable to an extraordinary extent. From 24 deg. to 111 deg. are extremes of temperature—24 deg. we experienced in June, and 111 deg. in January. The weather during the first six months was wet, cold, bleak, and damp, which conditions were entirely adverse to successful egg-production. For the first six months the rainfall totalled over 17 inches, and when it was not actually raining the ground was sodden and damp, making the whole atmosphere chilly and cold, with very little sunshine for the whole period. A very large percentage of the hens broke into moult, evidently through the extraordinary weather conditions. June was one of the coldest months on record since the establishment of the College and the wettest July on record, no less than 11 inches of rain falling and extending over a period of 19 days. This downfall flooded most of the pens, and the ground being sodden with previous rains, it was some weeks before it became thoroughly dry again. As an instance of the effects of these conditions, it is only

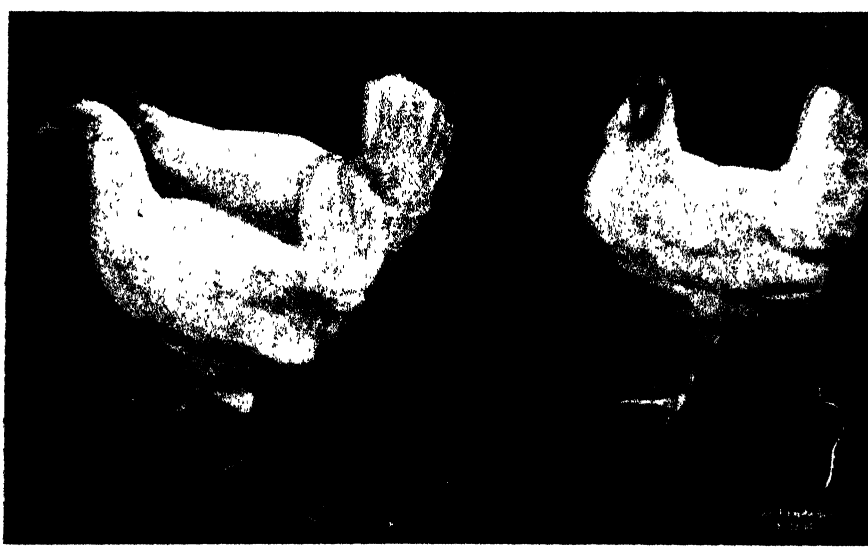
necessary to mention that on the 8th of July, the daily collection of eggs was 333, and after four days' rain it fell to 177. A further illustration of the severe weather conditions in the first six months is the fact that, while we were 86 eggs per pen behind the average for the first six months of the previous competition, we are 9 eggs ahead for the last six months, compared with the last half of the second competition.

The System of Feeding.

"The birds were fed at regular hours, viz., 7 a m., mash; 10 a.m., green food (more or less, according to the condition of the grass in the pens), meat (*i.e.*, cut up boiled liver) at 3 p.m., twice a week, and grain at 4·30 p.m. The mash was composed of pollard and bran, about three-quarters pollard to one-quarter bran, more or less, according to the quality of the pollard, and mixed up with hot soup twice a week, and other days with hot water in the winter months, and cold water in the summer. The green food consisted of finely chaffed rape and lucerne, both splendid foods. The rape is the better alterative, while lucerne is the higher in food value, so that the merits of the two green foods lie in different results. This year the grain ration was composed of three parts wheat to one part maize, compared to three parts maize to one part wheat last year; and while we have no wish to put the shortage of eggs compared with last year down to wheat-feeding, we have no hesitation in saying that if we had fed more largely on maize we would have had at least equal results, or even better. Shell-grit and fresh clean water were always before the hens.

Marketing the Eggs.

"The eggs were marketed in ordinary patent egg-cases, holding thirty-six dozen, packed into cardboard fillers. The eggs were packed clean, without washing, the dirty ones being laid aside, also any that were too large for the square space, or any that were



Rose Comb White Leghorns.—J M. Anderson, America.

too small. This is a simple and satisfactory way of grading. The eggs when sent to market always commanded the highest rate, and often 1d above it, so that it was no assumed price on which the value of the eggs produced was based.

Mortality and Disease.

"During the currency of the competition, fifty-three, or 9 per cent., of the hens died. This included fourteen deaths from the heat wave of December last, when the maximum reached 111 degrees in the shade. It speaks well for the health of the stock from the breeders' yards when we are able to chronicle the fact that the whole of these deaths were from an ovarian nature, caused by excessive laying, with the exception of about four

cases, which were from hereditary complaints—viz., abscess of the anus. No contagious or infectious disease was discovered among the 600 hens throughout the whole trying season of extremes of cold, wet, and heat."

The Financial Aspect.

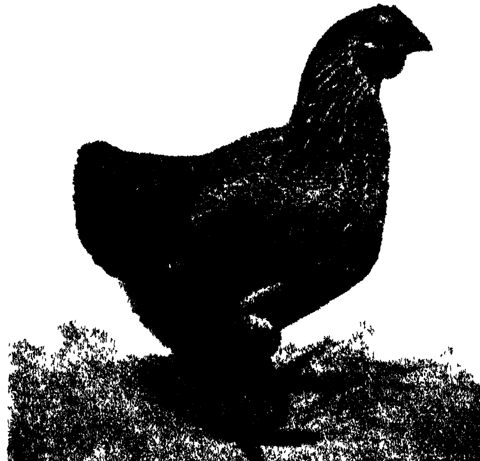
"The prices of foodstuffs were much lower than last year, and there was not so much fluctuation. The prices charged to us under contract, right throughout the currency of

Rhode Island Reds.—Dr. J. Martin, America.

the competition, were 8¾d. per bushel for bran, and 9½d. per bushel for pollard. Our average price for wheat was 3s. 4d. and for maize 2s. 6d. per bushel. The cost of feeding the 600 hens for the twelve months was as follows:—Wheat, £47 1s.; maize, £12 17s. 10d.; pollard and bran, £44 2s. 1d.; meat, £20; green food, £7 10s.; shell-grit, £2 10s.; total, £134 0s. 11d.

"The monthly laying was: April, 2,383; May, 3,383; June, 4,900; July, 7,782; August, 10,423; September, 10,216; October, 10,829; November, 10,286; December, 9,409; January, 7,769; February, 7,236; March, 6,565. Grand total, 91,169 eggs, or 7,597 dozen.

"The monthly range of prices for eggs was: April, 1s. 9d. to 2s. 1d.; May, 1s. 11d.; June, 1s. 10d. to 1s. 3d.; July, 1s. 4d. to 11½d.; August, 11d. to 8d.; September, 8½d. to 7d.; October, 7d. to 7½d.; November, 8d. to 11d.; December, 10d. to 1s.; January, 1s. to 1s. 3d.; February, 1s. 3d. to 1s. 4d.; March, 1s. 6d.



Silver-pencilled Wyandotte.
E. G. Wyckoff, America.

"The market value of the eggs was £382 12s. 7d., from which deduct the cost of feed, £134 0s. 11d., and a profit of £248 11s. 8d. is left on the 600 hens. Every pen showed a profit on the cost of feeding, the pen returning the smallest value leaving a margin of 14s."

Third Annual Egg-laying Competition Records.

The appended table gives full details of the laying and the value of eggs from each pen of six hens. The value has been calculated on the basis of the prices obtained for best new-laid eggs at the auction sales in Sydney each Friday. The age given is the average of the six birds at the commencement of the competition:—

Owner, Address, and Breed.	Age—Months.	Eggs Laid. April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Totals.	Weight per doz.	Market Value.
															oz.	
1. G. Howell, Wentworthville: Silver Wyandottes	7¾	86	76	107	93	102	110	102	132	110	122	111	73	1224	24	113/10
2. J. Lowe, Wentworthville: White Leghorns	7½	36	51	78	97	119	122	134	135	143	125	93	60	1193	26½	101/9
3. J. M. Anderson, America: Rose-comb White Leghorns	12	32	67	81	111	113	110	125	123	118	108	104	87	1179	23¾	113/10
4. F. J. Brierley, Carlingford: White Leghorns	7½	49	54	31	83	136	130	154	153	144	116	66	55	1171	24½	97/2
5. Mrs. E. Scaysbrook, Gosford: Black Orpingtons	7	59	95	74	106	141	120	108	112	93	88	82	77	1155	25	104/2
6. S. Ellis, Botany: White Leghorns	8	18	52	46	58	135	119	138	131	126	110	100	87	1120	28	93/-
7. V. J. Zahel, Marsfield: White Leghorns	8¼	..	..	16	115	108	106	134	151	147	125	109	105	1116	23½	89/1
8. A. J. Byrne, Eastern Creek: White Leghorns	7½	70	33	20	124	119	121	129	124	120	98	73	72	1103	26	94/1
9. Oceanside Poultry Farm, America: White Wyandottes	10½	31	66	73	82	123	122	124	113	111	84	84	88	1101	25	95/3
10. W. H. Peters, Waratah: Golden Wyandottes	9½	57	77	113	114	121	112	114	93	83	69	68	74	1095	23	100/3
11. J. Potts, Wingham: White Leghorns	7	32	91	30	67	109	124	142	147	128	103	74	44	1091	25½	92/4
12. Mrs. J. J. Roche, Bayview: White Leghorns	7	22	34	59	66	95	111	131	138	124	110	110	91	1091	28	92/4
13. Royle Poultry Farm, St. Leonards: Black Orpingtons	7½	51	88	72	82	123	105	111	93	113	92	74	75	1079	26½	97/4
14. C. Bridekirk, Enfield: Black Orpingtons	7	11	65	104	78	110	115	124	113	107	100	75	76	1078	27	91/10
15. F. J. Powney, Dulwich Hill: Brown Leghorns	8	..	11	59	91	122	128	148	130	121	106	89	69	1074	25	85/-
16. Mrs. A. H. Hansel, America: Rose-comb Brown Leghorns	10	87	113	62	84	105	116	125	103	96	83	54	43	1071	23	99/3
17. W. Cook, Balmain: Black Orpingtons	7	1	45	96	100	91	102	121	117	103	94	79	118	1067	28	92/1
18. Dr. J. Martin, America: Rhode Island Reds	9¼	74	96	66	56	116	101	106	104	82	73	93	89	1056	25½	88/7
19. W. Wild, Lake Albert: Black Orpingtons	7½	67	1	63	90	98	104	138	120	111	85	92	80	1049	28	91/1
20. A. Wedlich, Caulfield (Vic.): Black Orpingtons	8½	38	43	35	96	112	101	108	114	117	83	105	93	1045	26	90/8
21. B. T. Forrest, Sutherland: Black Orpingtons	7¼	.	72	93	100	126	105	120	110	90	85	57	80	1038	23	89/5
22. D. J. Stephens, Pitt Town: Silver Wyandottes	7½	76	42	84	87	103	108	113	89	107	71	82	75	1037	23	93/7
23. Horwood and Dennis, Wagga Wagga: White Wyandottes	7½	62	55	44	112	121	108	111	90	93	82	69	88	1035	23	93/4
24. F. R. Small, Richmond: White Leghorns	7	24	44	29	77	111	97	124	135	125	113	85	69	1033	26	86/6
25. J. Stewart, Berowra: White Leghorns	8	3		25	106	116	111	114	131	127	103	102	89	1027	24½	80/3
26. A. Arnold, Ashfield: White Leghorns	7½	35	11	9	68	118	128	141	135	132	127	73	47	1024	27½	79/11
27. Ventura Poultry Farm, Miranda: Silver Wyandottes	7½	43	44	91	86	111	107	113	87	97	87	74	81	1021	24	90/6
28. J. W. Woodland, Penrith: Black Hamburgs	7	4	25	50	91	125	108	114	118	106	82	82	89	994	22	81/5
29. C. H. Wickham, Roseville: Black Orpingtons	7½	50	67	93	83	110	87	94	86	84	81	78	75	988	23	90/9
30. C. Chapman, Elderslie: White Leghorns	9	22	11	48	113	125	102	114	118	85	95	75	78	986	26	81/5
31. H. Pannell, Christchurch (N.Z.): Buff Orpingtons	6¾	25	13	58	119	112	107	115	107	92	78	79	79	984	25½	82/7
32. W. H. Tombs, Springwood: Anconas	8	56	68	72	87	91	89	102	114	104	76	77	46	982	26½	79/3
33. Ponton and Son, Tuggerah: Langshans	7	..	.	43	117	95	121	118	117	100	104	65	100	980	26	79/-
34. E. Solomon, Waratah: Buff Leghorns	7½	28	81	76	99	107	90	103	88	76	74	74	77	973	24	87/10
35. Bonaventure Poultry Farm, Mount Druitt: Black Hamburgs	7	2	..	..	24	102	117	141	144	134	114	114	80	972	25	74/1
36. J. D. Callaghan, Concord: Buff Orpingtons	7¾	27	54	55	104	114	84	100	78	95	78	89	85	963	26	84/-
37. C. A. W. Weil, Ashfield: White Leghorns	7	64	71	18	71	113	125	125	110	93	63	52	55	960	28	82/10
38. Veness and Fox, Ashfield: Silver Wyandottes	9	63	68	61	83	105	94	80	88	69	87	78	84	960	25½	88/10
39. Mrs. N. Kirby, Ryde: Buff Wyandottes	8	38	82	72	90	101	103	105	85	85	86	47	63	957	26½	93/4
40. J. B. Smith, Parramatta: Silver Wyandottes	7½	..	..	75	125	110	89	100	103	98	80	87	88	955	23¾	79/3

41. W. E. Boutcher, Canterbury : Imperials	8	..	13	110	83	101	96	113	104	98	86	70	75	949	25¼	88/6
42. H. E. Kelly, Ashfield : Black Orpingtons	7	..	..	80	92	123	109	96	77	94	78	111	72	932	26	75/10
43. L. L. Ramsay, Carlingford : Black Orpingtons	9	12	23	48	111	131	94	111	105	92	72	83	49	931	27½	75/11
44. Dr. Fiaschi, Sackville : Brown Leghorns	7	21	20	23	50	92	111	107	120	124	78	98	80	924	24	64/5
45. G. Bernauer, Auburn : Buff Orpingtons	9½	2	35	79	87	110	98	96	92	88	90	64	80	921	23	77/9
46. M. Ward, Gosford : Black Orpingtons	9	37	31	52	69	113	109	110	103	101	58	54	82	919	25	77/11
47. S. Kendall, Kiama : White Wyandottes	7¼	..		15	57	122	118	124	116	102	100	76	83	913	25	68/10
48. Mrs. E. Battey, Richmond : Buff Wyandottes	7½	68	63	52	79	87	82	98	90	77	78	81	51	906	28	83/2
49. J. Howe, Annandale : Black Orpingtons	7	7	28	42	38	102	126	119	116	102	85	71	64	900	26	71/8
50. W. and F. Ottery, Campbelltown : Buff Orpingtons	8	23	72	68	87	110	93	103	87	67	56	68	65	899	25¼	79/4
51. J. F. Scobie, New Lambton : Silver Wyandottes	8	..		34	113	120	103	93	93	91	85	79	87	898	26	71/9
52. E. W. Lee, Kiama : Black Orpingtons	8	..	15	57	74	63	112	120	120	94	87	82	73	897	25½	73/4
53. A. Munro, Rockdale : Buff Leghorns	7	..	12	64	80	118	107	119	100	103	43	80	70	896	23	71/9
54. Miss E. Wright, Merrylands : Buff Orpingtons	8	23	38	74	85	109	90	74	84	92	78	71	73	891	25½	77/10
55. H. A. Jones, Thornleigh : Black Orpingtons	9½	15	19	66	70	97	95	97	88	97	84	68	83	879	27	74/3
56. J. Gamble, Ashfield : Buff Orpingtons	10½	111	70	38	50	101	92	81	66	60	62	63	76	870	24½	83/-
57. Mrs. C. Burke, Naremburn : Silver Wyandottes	10	16	33	66	85	98	93	93	79	84	69	80	73	869	25	73/11
58. H. H. Bassan, Tenterfield : Silver Wyandottes	8	8	23	57	78	86	117	109	89	93	70	79	60	869	25	68/11
59. E. Waldron, Willoughby : Black Orpingtons	7	13	25	49	89	121	91	107	114	63	78	73	37	860	25½	63/5
60. C. H. Bayley, Croydon : Buff Orpingtons	8	23	21	72	77	113	104	84	89	80	64	68	64	859	23½	71/3
61. W. F. Evenden, Croydon : Andalusians	7½	2	18	12	38	99	122	133	114	115	58	79	62	852	28	65/4
62. W. Gibson, Penrith : Jubilee Orpingtons	8	35	48	56	54	106	83	96	90	90	73	54	63	848	25	73/4
63. G. W. Commins, Wagga Wagga : Silver Wyandottes	10	15	3	35	83	106	117	114	83	75	64	69	82	846	25	67/5
64. E. Traherne, Christchurch (N.Z.) : Minorcas	7	23	5	4	69	108	107	113	113	88	73	84	57	844	28½	66/3
65. F. Greenwell, Mittagong : Pile Leghorns	8	32	61	73	74	94	98	92	82	61	65	66	45	843	25	73/11
66. S. B. Kennard, Toowoomba (Q.) : Golden Wyandottes	9	45	40	57	82	98	85	93	75	75	60	53	76	839	25½	74/4
67. A. E. Henry, Ryde : Silver Wyandottes	9	8	23	37	77	109	80	95	102	87	48	85	86	837	24	70/-
68. D. Stearn, Darlinghurst : Black Orpingtons	7	22	7	36	116	128	82	96	93	99	54	65	35	833	26½	67/3
69. H. Donnan, Bexley : Silver Wyandottes	8	60	28	50	74	93	81	85	74	90	56	71	71	833	26	75/1
70. L. Hunter, Penrith : Buff Orpingtons	7½	..	35	75	69	105	79	102	91	80	62	76	55	829	22½	69/4
71. Mrs. J. M. Allen, Rockdale : White Wyandottes	8	32	51	46	54	92	87	105	81	73	70	73	63	827	23	72/2
72. W. A. Hunter, Kiama : Silver Wyandottes	8	10	..	23	114	89	90	81	99	90	85	69	75	825	26	67/3
73. Arcadia Poultry Farm, Arcadia : White Wyandottes	7½	51	38	45	73	104	93	91	73	65	58	50	68	809	23	70/8
74. W. E. Cates, St. Ives : Black Orpingtons	7¾	4	112	42	87	83	109	106	110	88	70	57	40	808	25	63/10
75. A. Wood, Quirindi : Minorcas	7	..	19	47	43	85	108	84	106	120	103	62	25	802	29½	62/10
76. Miss N. A. Pratt, Smithfield : Silver Wyandottes	10	45	55	64	85	92	82	103	73	62	49	50	41	801	26½	70/5
77. C. Bowditch, Reefton : White Leghorns	8	3	1	3	24	89	95	124	125	95	97	89	53	798	30	60/2
78. H. S. Bignell, Bandon Grove : Golden Wyandottes	7½		16	21	62	107	113	101	90	70	61	81	74	796	24½	62/7
79. H. Devine, Ashfield : Buff Leghorns	7	8	61	74	58	82	76	83	99	75	79	54	42	791	25	69/10
80. E. G. Wyckoff, America : Silver-pencilled Wyandottes	10½	27	27	44	60	86	105	87	100	82	48	62	61	789	23	66/3
81. J. Ahern, Arncliffe : Brown Leghorns	7	15	27	23	44	94	99	102	94	110	80	58	42	788	26½	63/2
82. Grantham Poultry Farm, Plumpton : Rose-comb White Leghorns	8	7	33	25	41	87	118	118	110	94	61	52	35	781	26	60/11
83. D. B. Bannister, Pymble : Minorcas	7	7	7	4	60	56	110	120	123	106	95	67	25	780	29	58/3
84. W. Turner, Croydon : Minorcas	7	..	5	5	45	54	108	105	113	111	88	75	71	780	31	61/-
85. Guan Bros., Inverell : Silver Wyandottes	7½	..	..	39	84	98	85	103	96	81	72	67	52	777	26	51/2
86. D. T. Roots, America : White Rocks	10½	26	37	61	75	83	98	108	94	50	47	40	56	775	23½	66/1
87. G. Webster, Mullengandra : Black Orpingtons	8	..	11	25	102	103	100	100	83	68	70	51	53	766	27½	60/3
88. E. H. Maxwell, East Hills : Buff Orpingtons	7½	23	16	79	68	108	89	91	76	67	42	50	49	758	28	63/9
89. A. Baxter, Sans Souci : White Leghorns	7	3	23	35	59	92	111	115	120	88	51	38	18	753	27½	56/3
90. J. Harley, Balmain : White Wyandottes	7½	..	26	58	84	103	96	89	80	65	50	55	46	752	24	60/10
91. G. Craft, Ingleburn : Partridge Wyandottes	9½	11	60	55	61	115	94	103	75	58	42	17	61	752	24	62/5
92. F. Lewis, Blayney : Silver Wyandottes	7½	16	30	43	55	95	104	79	87	68	59	66	48	750	24½	61/10
93. H. van Dreser, America : White Leghorns	11½	27	14	..	40	81	81	96	121	104	63	69	54	750	27½	60/9
94. R. H. Wynne, Ashfield : White Leghorns	7½	..	9	8	66	113	106	128	117	106	37	35	7	732	30	52/10
95. G. L. Saunders, Randwick : Silver Wyandottes	7	1	36	42	84	101	73	85	70	75	54	50	50	721	26	60/-
96. W. Wilson, Wagga Wagga : Buff Orpingtons	8	3	..	..	30	117	101	96	93	91	66	55	51	703	25	51/-
97. D. Hogan, Islington : Langshans	7½	..	..	13	25	97	111	99	88	80	69	68	54	702	27½	51/11
98. Mrs. Thompson, Canley Vale : Langshans	9½	..	..	..	15	85	93	126	99	85	75	80	34	692	27	50/1
99. C. Davis, Blayney : Silver Wyandottes	8	..	3	9	95	96	75	87	72	69	59	64	52	681	22	52/1
100. W. Harris, Woy Woy : Partridge Wyandottes	7½	..	1	9	64	59	86	79	73	62	29	37	33	532	24	40/21

Sorghum at the Hawkesbury Agricultural College.

H. W. POTTS.

The growth of sorghum has been persistently advocated for several years past by the Department of Agriculture as a valuable and cheap fodder for live stock, both in its green form and conserved as ensilage; but there is ample scope for its extended growth, particularly throughout the dairying centres. The past season, with its great heat and scarcity of natural grasses, gave unmistakable evidence of the value of sorghum as a green fodder. The conditions of the season in this district were such as to point to special treatment in the successful cultivation of the plant, and as the results were highly successful, it may be of more than passing interest to relate the experience we have had from a crop of 30 acres. We have to recognise that in the growth of sorghum we are dealing with a plant more feeble and delicate in its early stages than maize and more readily choked by weeds. Where cultivated and intelligently cared for, it will more successfully withstand heat and prolonged drought than maize. The crop grown on the land two seasons immediately preceding its preparation for sorghum were first Algerian oats, and this was followed in the winter of 1904 by rape, which was eaten off by folding sheep on the crop.

Planters' Friend.

The ground was ploughed for the first time in September last, harrowed and rolled. It lay in fallow until the last week in December, when it was again ploughed, harrowed and rolled.

Sorghum Crop—Planter's Friend.

Sorghum Crop.

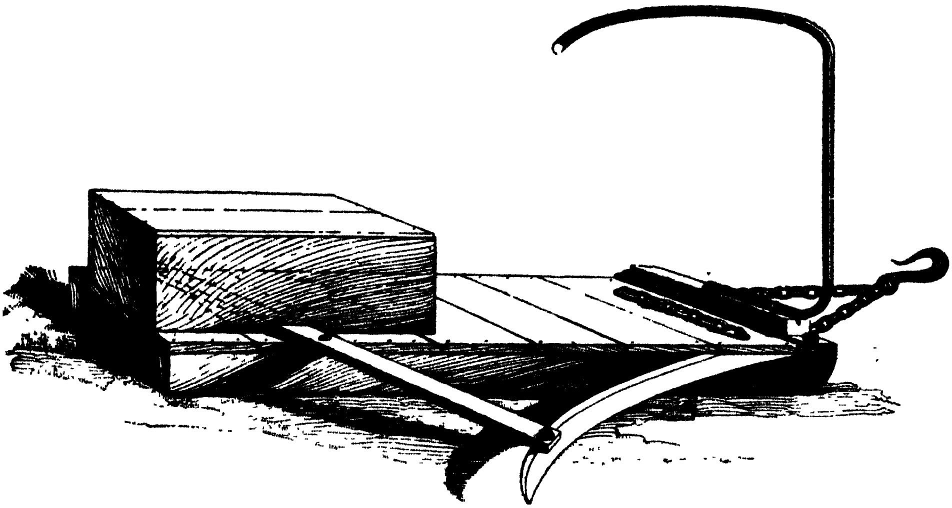
Maize. **Sorghum.**

The variety selected was one of the sugar-producing Imphees, known as Planter's Friend. The method adopted of sowing was by using the Champion drill used for wheat. Only three tubes out of the thirteen were left open through which the seed could pass, and the other ten tubes were utilised for distributing the fertiliser, and were choked to stop the seed. Seven pounds of seed to the acre were used. One cwt. per acre of fertiliser was applied, composed of equal parts of Shirley's No. 1 Superphosphate and bone-dust. Owing to the absence of moisture, the soil was very fine and dry, and hence harrowing only was done after sowing; rolling was omitted.

The dry weather which had prevailed for several weeks continued, with the exception of a shower, which fell shortly after sowing. This caused germination, and no rain fell until February. It was

Harvesting with Reaper and Binder.

recognised that if the crop was to be saved continuous cultivation must be followed, particularly through the period of extreme heat which prevailed during the early part of January. The Massey-Harris spring-tooth



Scythe-blade Cutter.

cultivators were used constantly to the end of February. The crop was cultivated six times until it was about 2 feet 6 inches high.

The crop was cut the first week in May for ensilage. It was from 8 feet to 10 feet high, and averaged 10 tons to 12 tons to the acre. The M'Cormick

Scythe-blade Cutter at work.

reaper and binder was used to cut part of it, and the other portion was cut with the sledge and scythe attached. The latter is a useful appliance, with which from 3 acres to 4 acres per day can be dealt with.

The following is a fair estimate of the cost of raising and manipulating the crop from the preparation of the land into the silo :—

	£	s.	d.
Ploughing, 1st time, per acre...	0	10	0
,, 2nd ,, ...	0	8	0
Harrowing twice, at 9d. per acre	0	1	6
Rolling twice, at 8d. per acre	0	1	4
Seed (7 lb.), at 3d. lb. ,, ...	0	1	9
Manure { Superphosphate, Shirley's No. 1, ½ cwt., 2s. 3d. ... ... Bone-dust, ½ cwt., 3s. ... ... }	0	5	3
Drilling seed, and manure	0	1	6
Cultivating six times	0	6	0
Cutting with reaper and binder	0	3	0
Twine	0	1	0
Drawing, 10 tons, at 1s.	0	10	0
Cutting and siloing, 10 tons, at 9d.	0	7	6
5s. 9d. per ton.	£2	17	7

RAINFALL.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total Points.
1904.																																
September																				4							36	11	2			53
October. ..					1						14	56	34	28	33	17		2		7												192
November			6								68			8			48	7										26		1		164
December										6			1			3	42	35	4½			6										98
1905.																																
January ...				9	5																	1	20				2	9		23	27	96
February		½	3										8	6	25	47		11½		1						2½						104
March ..		26	65	158		5			1								3					14	33	5½		3	9	22	10			354
April	1	23	38	49	152	61					3	2	7	31						1						1	1	21		4½		395

These Rain Records are taken at 9 a.m. each day.
The fall in each case occurred during the previous 24 hours.

No rain fell between 1st August and end of February that penetrated the soil more than 6 inches. December, January, and February were very dry; the usual hot weather prevailing during these months rapidly carried away the surface soil moisture—probably these three months were as dry a summer period as we ever experienced. By the end of January the soil was extraordinarily dry, even for a considerable depth (18 inches and more). It was not till 4th March that moisture penetrated the soil for a foot. (The previous subsoil rain fell in July, 1904—our coldest month when rainfall is but little use to crops here.) Fortunately hot winds were scarce during the dry period, though the last week of December and the first in January gave very severe heat. It was remarkable that no useful rain fell between 19th December and 16th February. The "revival rains" over the dry period occurring on 27th September, 12th October and three following days; 11th, 17th, and 28th November; 17th and 18th December; 30th and 31st January; 15th and 16th February. From the above it would appear that good revival rains fell through the period, but it must be remembered that November, December, and January are our hotest months with but little moisture in the air, evaporation being at its maximum. The dry conditions that prevailed were much more severe than the records would appear to show. It is but seldom we have so small a quantity of rain during the three hot months, indeed only in one season during fourteen years.

Broom Millet.

GEORGE MARKS,
Experimentalist, Hawkesbury Agricultural College.

From time to time numbers of inquiries are received from different parts of the State asking for information regarding the cultivation, harvesting, and marketing of broom millet. In recent years the price has fluctuated considerably, according to the supply and demand, and in the seasons which follow an unusually high market many farmers attempt to grow this crop who have but a slight knowledge of the requirements of the plant, and of the practical details from the selection of the seed to the harvesting, curing, baling, and marketing of the brush. The result is that the market is glutted with millet of inferior quality, and the returns give little, if any, profit to the grower. Besides this, manufacturers, in order to obtain the quality necessary for making their best goods, are compelled to import a large proportion of their supplies. We have in New South Wales soil and climate fully capable of producing the very best quality, and it is significant that those growers whose practical knowledge teaches them to produce only the very best, are handsomely repaid for their outlay.

At the present time, there is a Federal duty of £4 per ton on broom millet, and with this protection there is no reason why we should not only produce enough for our own requirements, but become exporters as well.

The following table compiled from "Coghlan's Statistical Register for 1903 and Previous Years," will convey an idea of the area under cultivation since 1895:

Year.	Acres.	Weight of Brush in cwts.	Average Yield per acre in cwts
*1895	1,115		....
*1896	865	...	
*1897	621		
*1898	897	...	.
*1899	681	. .	
*1900	1,686	......	...
1901	3,203	25,505	8·2
1902	2,574	16,862	6·6
1903	1,901	10,413	5·9
1904	2,212	16,449	8·1

* Information regarding yields not collected.

For the season 1903-4 the area was distributed as follows:—

North Coast, from Hunter to Tweed .	1,957 acres.
South Coast	9 ,,
Tablelands	133 ,,
Western Slopes and Riverina	113 ,,
	2,212 acres.

Fully 90 per cent. of the millet produced in this State is grown on the rich alluvial lands of the north coast, and on several of these rivers, notably

the Hunter, Richmond, and Manning, the industry may be looked upon as lucrative and permanent. Several farmers have reported their success with this crop, and would not think of reverting to the far less remunerative occupation of maize growing.

Broom Millet Plant—White Italian.

The raising of millet need not be confined to these districts, as with the necessary care, and with the aid of a few home-made contrivances, any land which produces twenty-five or more bushels of maize to the acre will yield profitable returns. On many of our western slopes it should also thrive, particularly in those localities where irrigation can be carried out. It is wise before entering extensively into the production of broom millet to ascertain from agents or manufacturers the probable requirements of the trade, with a view to gaining an idea of the prices likely to be obtained during the season. At the same time, should the prices fall after the crop is harvested, the millet may, if properly cured and baled, be stored for a considerable time without injury.

The following information may enable beginners in broom millet-growing to avoid some common mistakes, and not to neglect any of the important operations which are essential to success.

Broom corn or broom millet (*Andropogon sorghum vulgare*) is a non-saccharine variety of sorghum. Like the other members of the same family, it is much hardier and will stand the effects of drought much better than maize. It is grown for the fine stems composing the head or panicle which is used extensively in the manufacture of brooms and similar articles.

Class of land required.

Soils that will grow maize and sorghum are well suited for the growth of this crop. The best, of course, are the rich alluvial lands of our rivers, but the millet is capable of adapting itself to a variety of conditions, and with proper care and attention, sandy and even gravelly soils, if thoroughly drained, will produce fair returns. Undrained lands make the working and cultivation more difficult; the growth is generally slow and uneven, and there is a greater chance of the crop becoming stunted and diseased. To ensure evenness in ripening, a soil uniform in character and fertility and with good drainage is essential.

Preparation of the land.

In order to get the best results the land must be properly prepared and

Sowing Broom Millet.

brought to a fine tilth before sowing. If possible the previous treatment should be such as would destroy weed seeds. The presence of weeds in the early stages seriously interferes with the cultivation and growth of the young plants. Deep ploughing is recommended. This not only ensures greater feeding room for the roots, but it also has the effect of increasing the moisture-carrying capacity of the soil, a fact which must always be remembered, especially in those districts where the rainfall is limited and irregular.

The nature of the subsoil must be considered in ploughing. Clays should not be brought to the surface, but can be materially improved by subsoiling. Ploughing operations should be commenced a couple of months before sowing time. This not only allows the land to sweeten by exposure to the weather, but all vegetative growth turned under is generally well decomposed by the

time the second ploughing takes place. In early spring the land should be well fined down by means of the harrow, disc, roller, &c.

Sowing and Cultivation.

Sowing usually takes place as soon as all danger of frost is over. Drills 4 or 5 inches deep are struck out with the plough (a double mould-board one is preferable), about 3 or 3½ feet apart, and the seed planted along these by hand or machine. The latter is preferable, as it sows more uniformly; and by utilising a fertilising attachment chemical manures may be supplied at the same time. The Farmer's Friend seed-drill, which sows and covers the seed

Cultivating Broom Millet.

in the one operation, is one of the best on the market. During hot or dry weather, the seed should be sown soon after the drills are opened, and before the soil has had time to dry. When this system is adopted, hilling can be dispensed with. This prevents a great deal of soil evaporation, as there is a smaller area exposed. Besides this, the plants, having their roots deep in the soil, have plenty of support, and are not so quickly affected by dry weather. The amount of seed varies from 6 to 8 lb. to the acre. When the plants are 6 inches high, they should be thinned out to 3 or 4 inches apart for rich soil, and more space allowed each plant in poor ground. With good clean seed, the drill may be set so that very little thinning is necessary,

thereby saving a tedious and rather expensive operation. The quality of the brush is affected to a very large extent by the manner in which this thinning is carried out. If too much space is allowed, the plants grow strong and vigorous, and produce coarse and unmarketable brush. On the other hand, if crowded, they become fine and weak. To get an even crop it is essential to have regular sowing and germination, and later on to thin out the plants to a uniform distance. Some growers sow the seed in hills, 15 to 20 inches apart in the drills, leaving from six to ten stalks to each. The seed should be covered from ½ to 1 inch deep, the depth depending upon the character and state of the soil. If it is dry, deeper covering is more necessary than would be the case if the soil were in a good moist condition. Where labour is scarce, several sowings should be made in succession, to enable the grower to deal with his crop at regular intervals. Rolling the land as the seed is planted ensures a prompter germination and a better stand, particularly if the soil is a little dry. When drilled, the roller at the rear of the machine is quite sufficient. Should heavy rains fall after the seed is sown, and before it has germinated, a light harrow should be run over the land as soon as the soil will permit. When 6 inches high the crop may be harrowed, to keep the soil loose and to gradually fill in the drills, and thus destroy any young weeds. The millet makes rather slow growth for the first couple of weeks, and the cultivator should be kept going every fifteen or twenty days, in order to keep the soil in a fine loose condition and prevent weed growth; and in every instance the ground should be worked after rain. For large areas a two-horse cultivator is used. When the crop is half-grown it may often be left to look after itself; but the surface-roots of the plants must not be disturbed by cultivating too deeply. In moist districts the crop may be hilled lightly, as an extra support is necessary. It is during the early stages that the cultivator is of greatest value, as the soil may then be loosened fairly deeply. The most critical period is when the heads are forming. If dry weather should set in then, the brush will be short and stunted. It may be necessary in some districts to sow early or late in the season, to avoid such trying conditions.

Manuring.

A crop of cowpeas following wheat, maize, or potatoes improves the land intended to be planted the following spring with millet, not only by enriching the soil, but also by clearing it of weeds. Millet will also do well after turnips or potatoes, and may be included with advantage in a rotation for the farm. Such crops as cowpeas, field-peas, vetches, and clovers are suitable for green manuring, and may be ploughed under in a green state, or grazed off by stock. This latter system works well when mixed farming is carried out, and stock of different kinds are kept. Vegetable matter should be ploughed under early, to give it ample time to decompose before sowing. Farmyard manure, if available, is also a first-rate manure to apply, as it not only supplies the elements required by the plants, but improves the mechanical condition of the soil. Chemical manures are also valuable,

and are very easily applied. Superphosphate, bone-dust, blood, and sulphate of potash will be found the most suitable. The proportions used for maize or sorghum will do equally well for broom millet. The following gives a complete fertilizer, and may be applied at the rate of 2 to $2\frac{1}{2}$ cwt. per acre.

Superphosphate	80 lb.
Dried blood	64 ,,
Bone-dust	50 ,,
Sulphate of potash	30 ,,

The manures should be passed through a sieve, to remove lumps and foreign substances, that would prevent them from passing freely through the drills. They should be thoroughly mixed just before sowing, as, if mixed any great length of time before required, they "set," especially if the weather is at all damp; and this necessitates breaking up and re-screening before use. It is impossible to state definitely what quantity of manure is required for each soil, growers would do well to conduct experiments on a small scale with manures mixed in varying proportions, and to notice which gives the best results. Soils, even in one locality, often vary considerably in their chemical and physical characters, and by such tests the farmer may soon determine which manure is most suited to his soil.

[*To be continued.*]

Monthly Weather Report.

HAWKESBURY AGRICULTURAL COLLEGE.

Summary for April, 1905.

Air Pressure (Barometer).			Shade Temperature.				Air Moisture Saturation = 100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 13 years.	Lowest %.	Highest %.	Mean %.	Most in a Day.	Total for Month.	Monthly Mean for 7 years.	% of the year's Evaporation.
29·76 14th.	30·39 17, 20, 24.	30·23	40·0° 21st.	82·2° 19th.	63·706°	63·133°	50 20th.	95 6 days	84	0·136 19th.	in. 2·388	3·053	5·0

Rainfall...	Date ..	1	2	3	4	5	10	11	12	13	19	25	26	27	29	Total for Month.	Mean rainfall for 13 years.
	Points..	23	38	49	152	61	3	3	7	31	1	1	1	21	5	3·96	2·642

	N	NE	E	SE	S	SW	W	NW
Wind	—	13	1	4	4	3	1	—

Thunderstorms on dates—27th.

Greatest daily range of Temperature, 35·5° on 19th.

Extremes of Rainfall, 0·232 in 1896; 7·961 in 1904.

Remarks.—A cool month. Only on one day did the shade temperature rise above 80°. Air moisture is increasing. Evaporation decreasing as we approach our winter. No frosts. Rainfall good. Wind moderate. One Southerly blowing up on the 19th. Frequent dews and fogs.

CHAS. T. MUSSON,
Observer.

Fruit-eating Birds.

C. T. MUSSON,
Hawkesbury Agricultural College.

Preliminary Note on replies to the Circulars lately issued.

OUR insectivorous birds have in the past claimed a considerable amount of attention; but of the fruit and grain eating species we have no large amount of information. It is for the purpose of trying to ascertain what birds are damaging crops, and to what extent, that growers have been requested, through the *Gazette*, to communicate any knowledge they have as to this subject.

It is found from reports sent in so far, and from local knowledge, that the kinds doing most harm are naturally either fruit and seed eaters, or insectivorous. It is not at all remarkable, when we think the matter over, that certain birds accustomed to eating insects and, like the Honeysuckers, also taking nectar from flowers, develop a taste for fruit; this selection of food naturally accompanies the possession of taste. Grape juice and cherry flesh are to the bird glorified nectar. Yet, whilst damaging fruit, most of these birds are living, for the most part, on their normal food. Fruit forms apparently their sweets and dessert, and frequently may supply their liquid requirements.

The species named as causing most damage are as follows (omitting the Sparrow and Starling; the former is being dealt with separately, and the latter will probably be taken up when the Sparrow work has been completed):—

Parrots.	*Honeysuckers.*	*Large Birds.*	*Small Birds.*
Rosella.	Yellow-eared	Crow	Silver Eye.
	White-eared	Black Magpie	
	Soldier	Blue Jay	
	Leatherhead.	Bower Birds	
		Oriole, or Thrush.	

Others are named, and will be dealt with in a later report.

This subject of birds damaging fruits and eating grain (the chief injury caused by them with which we are here concerned) is an important one, and requires to be looked at from several points of view. Perhaps the following bald statements, to be amplified at a later date, will open up the subject more fully to observers in the country, with the view of securing further and full co-operation from them in the way of getting as complete a knowledge of the subject as circumstances will permit:—

The hard-billed birds (as Parrots and Finches) live on seeds; the former damage fruits at times.

The soft small-billed birds find their natural food in insects.

Some birds take mixed food.

The larger birds have a wider range of food than the smaller forms; Crows and Magpies, for example, and they will even eat vermin.

The birds we complain about are usually insect or seed feeders in the natural condition.

Probably fruit is attacked more for sweet liquid pulp or flesh than as giving the solid food requirements, which must also be partaken of.

Clearing and cultivation having disturbed the natural balance existing between plants and animal life, the economic relations existing between the different sections of both have become more intricate.

Native fruits and flowers having been largely done away with, insects have to make use of cultivated plants, or die out. Native birds must follow the insects, and seek in and round our fruit-trees what they formerly found in the bush, but is now scarce there. Once fruit is tasted birds frequently become confirmed fruit-eaters.

Water is scarce at times, and, as we know from human experience, fruit juice makes an admirable substitute

Birds have their fancies for various fruits, indeed, certain species, owing to the possession of this taste, have been the means of spreading numerous bush, and possibly introduced plants. Blackberry has been widely spread in New Zealand, largely by the help of birds, so it is stated.

Birds inimical to our interests in the fruit season may be useful at other times, as the Silver Eyes, which in the winter consumes large quantities of insects, mainly collected from trees

It is pointed out* that mulberries are a very favourite form of food for many orchard birds, and also that fruit pulp may be a substitute for water where the latter is scarce

It has long been an article of faith in certain natural history circles that bird food ought to be provided, such hedge and other plants being used as will provide suitable food for our bird friends and possibly help to keep away from our crop fruits birds that would otherwise commit damage. One reason for hedge planting is in the providing of bird food This may keep birds away from our fruits

All small birds, as Dickies, Tits, and the like should be carefully protected, being insect eaters (Silver Eyes probably the only exception).

All birds are rather our friends than our enemies. Some are always friendly, others friendly at times, whilst at other times destructive. In the sum, however, they do more good than harm, at times, however, the amount of harm done is serious.

The economic relations of birds with respect to man have been well summed up by F. E. L. Beal† as follows :—"A careful examination of the circumstances in which birds have done harm leads to the belief that the damage is caused

* "How to attract the Birds," Neltje Blanchan.

† How Birds affect the Orchard. Yearbook of the Department of Agriculture, U.S.A., 1900, p. 291.

by an abnormal abundance of a species within a limited territory. In such cases so great is the demand for food that the natural food supply is exhausted, and the birds attack some of the products of garden or orchard.

"The best economic conditions are probably fulfilled when birds are numerous as species and moderately abundant as individuals. Under such conditions there will be a demand for food of many kinds, without excessive demand for any one kind. The most desirable status would seem to be such a relation of numbers and species between birds and insects that the birds would find plenty of food without preying on useful products, while the insects would be held in such check that they would neither increase to a harmful extent, nor be completely exterminated."

The proper course to pursue, apparently, is to study the food habits of both birds and insects, to favour the increase of species which seem best adapted to preserve the proper balance, and to reduce the numbers of those that prey too greatly on the products of farm and orchard.

Whilst the above statements can, on the whole, be agreed with, we have to remember that here we have no winter of sufficient intensity to drive birds away or kill them off; there is but little migration, and those birds that with us do migrate are not amongst the fruit pilferers.

We have in Australia somewhat different conditions in relation to our birds to those holding good in the States. Most of the fruit-eating forms are with us the year round, and we probably have not the supply of eatable fruits amongst our native plants that North America possesses."

Our aspect of this question will be fully discussed later in a general report on the subject.

Our Attitude with respect to Fruit-eating Birds and Birds in general.

Pending further investigation, the following points are put forward as tentative suggestions

1. Provide in the ordinary course of planting for shade, shelter, or other purposes a reasonable supply of plants suitable for bird food, as black mulberries. These might be planted away from the orchard proper, and might fulfil all the requirements for fruit in the case of certain species. It would be interesting to know whether here, as in the States, mulberries are a favourite fruit with birds.

2. Provide one or two suitable shallow water-troughs, placed on old stumps or some such stand, out of the reach of cats, for drinking and bathing purposes. This would attract the small birds; all useful kinds could be preserved, whilst detrimental species could be shot or driven away.

3. Whilst attracting useful birds, we must discourage in every way the destructive birds, and prevent nesting of sparrows and the like, as far as possible, about our premises.

4. Systematic shooting of the fruit-eaters would reduce their numbers and frighten them away. It is when they come in quantity that the most

damage is done, though many have the unfortunate habit of spoiling a good deal of fruit, taking but little from each grape or peach.

5. Poisoning is not to be recommended (except for sparrows); it is likely to kill off too many useful kinds. Poison should, therefore, be used with caution.
6. We can look to it that hawks and butcher-birds are not destroyed; they help to keep down the small birds. Exceptional cases may require their destruction.
7. Some suitable "scare" apparatus would act for a time in the case of grain crops and, perhaps, small fruits, it would be all the more effective if possessing a series of changes as to character of noise or appearance.
8. We must adopt the old English method of employing boys to scare the destructive birds away. This seems to be the most likely and practicable means for preventing damage by birds. The period during which damage might be done is not a long one, and the expense would, after all, not be excessive. Mechanical scares should be useful.
9. The use of traps and bird-lime might be extended; scolding birds are a fright unto their kin. They would require regular attention, or would be ineffective. Moreover, they should not be used where useful birds are likely to be destroyed, this is their chief danger.
10. At present it would seem that, to prevent damage to crops by birds, growers must rely on their own efforts, adopting such plan as seems most likely to be effective in their own special cases There is hardly likely to be any general specific applicable to all circumstances.

Each case will have to be dealt with on its own merits Taking the birds all round, even the fruit-eating forms, they probably do more good than harm, only we cannot see the good to estimate it, whilst the damage done is prominently before us. We should be careful, therefore, in our "bird crusade not to attempt more than keeping the destructive forms within reasonable bounds.

Special Notice.

All persons interested in the subject are requested to continue forwarding observations on the subject, as requested in the original circular Already much interesting matter is to hand, which will be used and acknowledged in due course. We want details as to methods of trapping, and, where possible, a description of the trap.

Details are especially desirable as to hawks in relation to other birds. For example, are they more plentiful when birds (or mice) are exceptionally numerous? Do any hawks take the fruit eating birds?

Experiences in relation to mechanical means for scaring birds is required. What appeared to be a very useful form of "Flying-fox Scaring Machine" was reported on from Parramatta some years since. It consisted of a gong and light, the motive power for sounding the former and revolving the latter being heavy weights attached to clock-work.

Dairy Notes.

M. A. O'CALLAGHAN.

Water in Butter.

The following is a list of analyses of the butters placed on the market by our various factories during last export season:—

Factory No.	Water per cent.	Factory No.	Water per cent.	Factory No.	Water per cent.
1	12·14	16	10·07	31	11·58
2	12·67	17	14·06	32	13·13
3	12·56	18	13·29	33	13·69
4	13·59	19	13·61	34	13·40
5	10·94	20	14·13	35	11·42
6	12·25	21	14·64	36	14·24
7	13·29	22	12·77	37	13·98
8	13·82	23	12·16	38	14·28
9	12·12	24	11·76	39	14·29
10	13·78	25	12·00	40	15·09
11	12·64	26	13·81	41	14·82
12	13·07	27	12·44	42	13·79
13	12·89	28	12·99	43	15·50
14	15·14	29	13·88	44	13·60
15	10·36	30	11·63	45	14·05

The 45 samples averaged 13·14 per cent. of water.

There were none under 10 per cent.

,,	3	between	10	and	11	per cent.
,,	4	,,	11	,,	12	,,
,,	12	,,	12	,,	13	,,
,,	15	,,	13	,,	14	,,
,,	8	,,	14	,,	15	,,
,,	3	,,	15	,,	16	,,

Potato Diseases.

There has appeared lately in the States and England a Potato Disease, called Brown or Dry Rot, caused by *Bacillus solanacearum*. The symptoms, as described in a recent pamphlet, are almost identical with those given in the paper on "Wet Rot in Potatoes," published in this *Gazette*, in February last, P. 186. It is quite possible that we have here the two troubles, real "Wet Rot," indicated mainly by the milky juice that exudes from the eyes of tubers, and the tuber becoming more or less mushy, whilst the other trouble may be a distinct thing and not an early stage of the "Wet Rot"

The "Brown Rot" disease mentioned above has only lately come under notice, and should ours turn out to be identical it will be another trouble added to the already long list. Pending further investigation, there does not need to be anything said with respect to coping with the disease. Treatment, such as it is possible to adopt, is the same for both forms of Rot.—Chas. T. Musson.

Report on Crops grown from seed supplied by the Department of Agriculture, 1904.

Grown at Toothdale Public School (Lower South Coast District).

J. A. BROWN, Teacher.

Chufus, or Earth Almonds, sown on 6th October, germinated in ten days; made good growth, but has not yet matured; still look healthy, and are about 10 inches high; prospects show well for maturity.

New Dwarf Bean (Sutton's Perfection), sown on 6th October, germinated in eight days; grew quickly and cropped prolifically; a very desirable bean.

New Bean (Sutton's Dwarf Sugar), sown 6th October, above ground in ten days; grew quickly and cropped prolifically; a very desirable bean.

Large Flat White Lentil (Tangie Pea), also Large Yellow Lentil, sown 6th October, above ground in ten days; rather slow at growing, but matured crop fairly good; no doubt, in favourable season, would crop heavily.

Sutton's Prince of Peas, sown on 7th October; above ground in nine days. Owing to dry weather, and lateness in sowing, these did not germinate well, and what did so grew not at all well; no doubt, if earlier sowings were made, they would be more prolific.

New Haricot Bean, sown on 7th October, germinated well, and well up in nine days, but, owing, to dry weather, they did not mature.

Runner Bean, Sutton's A1, sown 7th October, above ground in ten days; grew well but cropped badly; dry weather no doubt the cause.

Cowpeas, White Seed, sown 7th October, above ground in eight days; grew and matured well.

Cowpeas, Black Seed and Clay-coloured Seed, sown 7th October, above ground in eight days. Made much better growth than the White Seed; magnificent varieties, and very heavy croppers of pods and haulms. They are about five to six weeks later in maturing ripe grain than the White Seeded.

New Mangold Prize Winner, sown 7th October; did not grow well owing to continued dry weather; will try again this season.

New Pea, Sutton's Early Giant, sown 7th October; was not a success, owing, no doubt, to lateness in sowing, and dry hot weather, which is against pea culture.

White Italian Broom Millet, sown 7th October, above ground in eight days; grew well and withstood the dry weather well. We have collected enough heads to make a broom, which is in preparation. The stalks grew 7 feet high, and broom heads 30 inches long.

Japanese Millet, sown 7th October, above ground in eight days; grew well and withstood drought well; matured well, and with good seed heads. This should make capital hay; in fact, we dried a little, and it gave great satisfaction.

Crimson Swede Turnips, sown 7th October, above ground in eight days; owing to lateness in sowing, and dry weather, they were not a success. We have made further sowing during last month, and, should favourable weather prevail, they should prove successful.

In addition to the above, we are making a trial with peanuts. They have grown well. Sown on 9th September. Each plant now covers a space of about 18 inches square. They have withstood the dry weather admirably, and are now well in bloom. We have also a nice little plot of maize, four varieties, viz., Riley's Favourite, Pride of the North, Golden Beauty, and Tuscarora Flour Maize. Notwithstanding the dry weather we will harvest a nice crop, all owing to constant cultivation. We had about the finest crop of water-melons one would wish to see, some weighing 36 lb. The varieties grown were, Santiago, Hungarian Honey, Halbert Honey, and Wonderful Sugar-melon. We also had cucumbers and tomatoes in abundance. I may state that our neighbours put in seed of various crops, but, owing to the want of proper cultivation and manuring, their returns were almost *nil* compared with ours. We used Shirley's manure for all crops, and it well repaid us. Considering we are on top of a hill here, and no water for irrigation purposes, our results are astounding. We simply kept the moisture in by constant cultivation with horse and hand Planet Junior hoes. No watering was done, because we were compelled to draw water about three quarters of a mile for house purposes, our three tanks being empty owing to continued dry weather. We hope to be favoured with a few more seeds from your Department, but I would ask they be sent earlier than before. If you have any new choice melon, pumpkin, cucumber, tomato seed, &c., we would like it, and any other new seeds you wish us to try here. The four varieties of maize we grew were selected from twelve varieties grown last season—1903-4.

The majority of the boys under my charge evince a keen interest in what we are carrying out, and it is already exhibiting itself by their cultivating garden plots in connection with their homes. I encourage them by frequently giving them seeds and plants. We grafted about 200 different fruit-trees last August, also rowed over 2,000 pine seeds, which germinated well, the majority doing well, *Pinus insignis* being the principle grown, as it is undoubtedly the best for this district.

Grown at Public School, Cathcart (Monaro District).

D. C. SULLIVAN, Teacher.

In the first place, I would like to point out that the season has been an unusually dry one for this part of the State. The rainfall from 1st September to date is as follows:—September, 45 points; October,

164 points; November, 96 points; December, 83 points; January, 295 points; February, 123 points; March, 55 points. Winds were very prevalent during the year, and nullified any benefit arising from the rainfall. All the crops in the district were comparative failures, and this is an unusual record for Monaro. All creeks and lagoons are dried up, and drinking-water is scarce in many places. With such a state of affairs, then, it is not to be wondered at if I have not much to show for my trouble. I received from you a miscellaneous collection of seeds towards the end of October.

The following sorts of maize were planted on the 24th October:—

Tuscarora.—This did not do well, only a few stalks bearing cobs, and those very small. It has not yet ripened.

Pride of the North.—This did the best of all; the stalks, however, did not exceed 5 feet in height, but the cobs were large and well filled. This seemed to stand the dry weather best of all. The cobs averaged two per stalk.

Early Leaming.—This gave the best results as far as stalks are concerned, but it did not cob so well as the Pride of the North. This stood the dry weather next to the Pride of the North.

Golden Beauty.—This came third. The stalks averaged about 4½ feet; cobbed fairly well, but rather small and pinched.

King of Earlies.—This variety did least good of all, the stalks barely averaging 3 feet in height.

None of the varieties have yet ripened, and old hands say maize will not ripen on Monaro; but I am very much inclined to think it would do well here, given a good season. As fodder, it would do well. The climate is certainly uncertain, and we are likely to get frosts at any time. Slight frosts were experienced on the 3rd and 12th instant, but did not do much damage.

Millet.—The kinds planted were: White Italian Broom, Japanese, and Amber Cane, and all three did well, especially the Japanese variety. I am very pleased with the result of the Japanese millet.

Sorghum.—This also did well.

Grasses.—I tried Blue Texas, Red Clover, *Paspalum dilatatum*, and Rhodes grass. The whole lot are doing well, but the Rhodes grass and Blue Texas grew remarkably well, and are now beautiful and green, while all natural grasses are brown. The Rhodes grass spreads rapidly, but I do not know, of course, how it will stand the frost. I took a great amount of trouble with the Red clover, and at one time nearly gave it up as a bad job. I had to keep the ground well loosened and watered till just now. At one time it would grow well, and then it would wither and come round again. The Texas grass did not require much looking after, after it got a footing. I distributed about eighty roots among the farmers round, keeping twenty for myself. In the majority of cases it did well, only in one instance did it completely fail, and that was through neglect. I kept the ground well loosened and watered it occasionally, and have the best patch, though it is in the poorest soil of all. Only a few roots of the *Paspalum dilatatum* came up, but they are spreading rapidly—nearly as fast as the Rhodes grass.

Vegetables.—Pumpkins were a complete failure. I planted the first seeds about the 11th November, but they were destroyed by the wind. I planted a second lot the first week in December, and though the vines are healthy to look at, no fruit came on them; and even if fruit forms now it will be too late to ripen.

Cucumbers.—I planted the first lot of seeds the same time as the pumpkins, and they were killed by hot winds; I planted a second lot in December, and they bore profusely, though the fruit was small. The kind sown was the White Spine. I gave some seeds to a gardener (not a professional) and some fine samples were shown.

Beans.—The varieties sown were Canadian Wonder, Dwarf Lima, and Haricot, and all except the latter did well; they were planted during the first week in November.

Peas.—The Yorkshire Hero and Sutton's were sown and did very well. I think the Yorkshire Hero is the better.

Sweet Potatoes.—I planted these in the third week in December, but only two came up. I did not get the tubers from you. They are doing well so far.

Cabbage.—The two kinds grown were Burpees All Head and Succession. Mine did not do too well, but some I gave to others did well, especially the Succession.

Swedes.—The varieties grown were Purple Top and Sutton's Champion, and both kinds did remarkably well. I gave plants of these to several farmers, and, with all, the result was good.

Water-melon.—These and rock-melons did no good in the early part of the year, and, though they are coming on now, they are too late. In any case, melons, even when they do ripen, are not much good in this climate.

Sisal Hemp.—I planted half-a-dozen shoots of this, and all are doing well.

Owing to the dry weather I did not plant any mangolds.

This is the sum of my observations, but I hope to be able to give a better account of my work next year. I used Shirley's manure (Nos. 5 and 9) and found it very beneficial to potatoes, peas, and cabbage. I would like to get a further supply of seeds for next season. Lucerne is not grown here, but it should grow fairly well.

Another thing that is neglected here is fruit. Any seeds that you choose to send along will be attended to, and the results communicated to you in due course. Small samples of wheat, &c., would be welcome, as this is essentially a wheat-growing district, the principal kind grown being the Manitoba.

Report of the Superintendent of the Cold Storage and Export Branch.

THE Minister for Mines and Agriculture has received from Mr. Jackson, the Superintendent of the Cold Storage and Export Branch, Department of Agriculture, some particulars of the operations at the Cold Stores during the year 1904, as follows:—

RECEIPTS—Poultry, Rabbits, Hares, Butcher's Sundries, and Eggs, 1904.

Month.	Fowls.	Ducks.	Turkeys.	Rabbits, Pairs	Rabbits, Skinned.	Hares.	Butcher's Sundries.	Eggs.
January ...	...	...	...	20,736	6,600	...	...	102
February ...	...	543	...	69,744	1,746	24	...	103
March ...	...	210	...	73,752	60	...	...	1
April ...	46	208	...	89,988	...	396	...	...
May ...	...	20	364	222,732	...	2,904	24	...
June ...	...	...	114	154,248	...	9,924	19	
July ...	24	223	42	205,176	...	24,156	...	...
August ...	...	456	...	64,284	...	14,880	...	...
September ...	...	...	33	6,252	...	876	...	4,076
October ...	...	...	68	2,136	...	348	...	2,653
November ...	750	417	105	2,700	...	12	...	170
December ...	270	...	35	48	...	96	...	91
Total ...	1,090	2,077	761	911,796	8,406	53,616	43	7,196

DELIVERIES, 1904.

Month.	Fowls.	Ducks.	Turkeys.	Rabbits, Pairs.	Rabbits, Skinned.	Hares.	Butcher's Sundries.	Eggs.
January ...	...	...	11	15,684	4,860	48	2	98
February ...	...	...	9	43,056	3,750	...	1	128
March ...	...	...	...	69,036	150	...	...	506
April ...	...	...	...	4,296	...	...	...	1,151
May ...	...	...	...	43,344	...	...	18	927
June ...	...	...	301	329,160	...	708	25	719
July ...	24	367	188	137,268	...	18,888	...	169
August ...	...	...	2	230,448	...	18,132	...	38
September ...	...	726	16	44,136	...	11,088	...	1
October ...	46	81	36	4,104	...	1,500	...	2
November ...	750	590	150	672	...	1,944	...	67
December ...	...	283	37	2,700	...	1,236	...	195
Total ...	820	2,047	750	923,904	8,760	53,544	46	4,001

The goods packed, frozen, and delivered from the Government Cold Stores are estimated to have amounted in value to £49,092 15s. 6d., as enumerated below:—

Goods.	Amount. £	s.	d.
Fowls	92	5	0
Ducks	225	17	6
Turkeys	225	0	0
Rabbits in fur	32,721	12	0
Do skinned	105	0	0
Hares	2,677	4	0
Eggs	9,002	5	0
Butcher's Sundries	50	0	0
Milk	1,937	12	0
Poultry	2,025	0	0
Miscellaneous	31	0	0
Total	£49,092	15	6

The following figures show the quantities received in past years:—

Rabbits and Hares.

1901	Rabbits (pairs)	80,351	Hares (single)	124,666
1902	,, ,,	113,125	,, ,,	64,448
1903	,, ,,	640,541	,, ,,	42,796
1904	,, ,,	915,999	,, ,,	53,616

Poultry (Head).

1898	Poultry	16,753	1902	Poultry	120,161
1899	,,	22,808	1903	,,	4,487
1900	,,	44,505	1904	,,	3,928
1901	,,	73,140			

Eggs.

1898	11,000 dozen	1902-3	130,524 dozen
1899	93,000 ,,	1903-4	151,128 ,,
1900	96,000 ,,	1904-5	251,640 ,,
1901	140,292 ,,		

It will be seen from the above figures that there has been a marked increase in the quantity of rabbits received for export, and the quantity of hares is in excess of the numbers received in 1903.

In poultry there is a falling-off in numbers, due to high rates ruling locally, but in eggs for cold storage there is an increase of 100,512 dozen over the quantity in store in 1903, showing how greatly this system of egg preservation is being appreciated. The eggs arrived in such quantity that eventually all available storage space was occupied.

In a report received from Mr. Bradshaw, he says: Of the various crops, stock, or other produce of the farm, none lend themselves so readily to what is erroneously called speculation as do eggs; this arising from the fact that good year or bad, drought or flood, and irrespective of the reading of the thermometer, so sure as the April and May of each year arrives, the price of this universal and favourite article of diet realises double the prices that it did during the preceding September and October; so that if these goods can be safely

held over from the cheap time till the above assured dear season, it certainly is less of a speculation than that of the stockowner or wheat-growers delaying the disposal of their products for what is but the chance of a better market. It was the knowledge of the extreme difference between the winter and summer price of this article that prompted the Department, in 1897, to contemplate the shipment of a trial lot to England. The experiment was, however, arrested by a much-discussed article of mine in the *Agricultural Gazette* of November of the same year, showing that the goods could be safely kept for months; and if so, the local market for this product was a much better and less risky one than the English. Personal experiments, however, convinced the then Board for Exports that the cold air system was worth attempting, and provision was forthwith made for storing; and the result of the seven years' business is an emphatic confirmation of all the claims made for this, the one system of egg preservation that does not involve the application of a detested coating on the egg. The success of the system is evident in other directions than the actual thousands of pounds put into the pockets of the poultry farmer, one being that all misgivings as to the contents of the egg being affected have been dispelled, the goods being now openly sold as cold store eggs, and buyers have no hesitancy in purchasing such when they are of well-known brands. The daily papers also give separate quotations for such during the months when they are on the market.

The Department, by incepting the business, has conferred great benefits to the poultry farmer, who is usually a poor man, despite all the special pleadings as to the profitableness of the hen; and being in constant touch with many of these people, I can vouch for the fact that, apart from paying their storage dues promptly, they are grateful for the facilities offered.

The remarkable increase in 1904 of over 100,000 dozen from the previous year does not tell all, seeing they were received in a couple of months, whereas in previous years the stores were receiving such till after Christmas; and there is not a doubt but had there been space, over 10,000 cases would have been received. The result of our closing down gave an opportunity to other cold stores, and one at least has received a fair quantity, but largely in a class of packages we refuse to accept, viz., casks.

The great increase in the past year was due largely to the extension of poultry breeding, consequent on the low price of feed, coupled with the then high figures for eggs. The supply has, however, brought down the price, and already there is an anxiety by a few of them to get out of the business. However, the present prices are payable ones for those legitimately in the business, the fortune-hunters from fowls being disappointed in their ventures, as they would in any other business which gets unduly boomed.

As showing the extraordinary increase in the egg supply to the city from the previous year, the *Herald's* annual produce review will be of interest.

The figures are for those which arrived by rail only, and a like increase may reasonably be expected in the quantities received by road (suburban) and by South and North Coast steamers.

Eggs.

Cases received by rail in	1903	22,296 cases.
,, ,,	1904	33,251 ,,

or an increase of 33 per cent. However, despite the above increase, the numbers are not yet up to 1901, when 39,000 cases were received. The very much increased supply brought prices much lower than formerly; this, however, would not have been so pronounced but for the fact that during our most plentiful period, Adelaide, Melbourne, and Brisbane all shipped large quantities to Sydney, and, notwithstanding the low price ruling, it was a good deal better than at the prices mentioned, $3\frac{1}{2}$d. per dozen being the quotation of a Brisbane paper.

In closing his report, Mr. Bradshaw advocates the necessity for statistical returns of poultry in this State.

As to the very large quantity of rabbits received at the Government stores, the arrivals were in such volumes during May and June that, in order to safeguard the interests of all concerned, the Department was compelled to close the store. The firms who had been doing business at the Government stores fortunately succeeded in making temporary arrangements with the Fresh Food and Ice Company, Limited, and the Pastoral Finance Association, Limited, and the Metropolitan Ice Company, Limited. Government rabbit graders were employed at the works of two of these above-named firms, and the work was satisfactorily carried out. On the resumption of operations at the Government stores, the Department found it necessary to continue the freezing and storage of rabbits at the Fresh Food and Ice Company's works, and one of the large exporting firms made arrangements to continue freezing rabbits at Kirribilli works, the property of the Pastoral Finance Association, Limited, the Department sending the necessary Government graders to these works. It being recognised that London buyers looked for a Government Grading Certificate, it is satisfactory to note that firms are making use of the Department of Agriculture in its endeavour to uphold the good name and quality of this class of New South Wales goods, and London buyers are, to a great extent, enabled to protect themselves against speculative packers of goods not packed under Government supervision by insisting upon being supplied with goods bearing Government graders' marks or certificate.

The operations at the stores have given employment to a considerable number of persons, and, if it was possible to arrive at the amount earned by rabbit-trappers in the country districts, and, allowing for the cost of cartage and incidentals, together with the employment given to people selling rabbits locally, it is evident this industry is of consequence to a number of people, besides providing a cheap food when meat has been dear.

I think I am safe in saying that private firms are becoming more disposed to cater for this trade, so long fostered by the Department, and are not unwelcome; it means that in all probability a very much larger output of these goods will be the ultimate result. The attitude of the Department is not one of antagonistic competition, as every effort is being made to assist such firms in meeting the requirements of the English and other markets, and the relations existing between the Department and the large freezing companies are satisfactory.

During the year Mr. C. C. Lance, the Government Commercial Agent in London, has, from time to time, sent reports on shipments of rabbits arriving in London. These reports have been of much value to the Department, and, without doubt, the fact that Mr. Lance was able to keep the Department advised of the true state of affairs, has done much to deter statements being made that were likely to place these New South Wales products in an unsatisfactory light, and at the same time a good name has been secured for New South Wales rabbits and hares. In a recent report from Mr. Lance, he says: "The New South Wales rabbits continue to be held in high esteem, and a higher price is obtained for them than for rabbits elsewhere, the 'Blue Mark' being always inquired for." The "Blue Mark" refers to first-grade rabbits, packed in crates on which the printing is stamped in blue colours. Second-grade rabbit crates from New South Wales are printed in red lettering. The Department has endeavoured to limit the number of grades, and, if possible, would dispense with a second-grade pack. It is alleged by some exporters that they have a market for second-grade rabbits and hares, while some shippers are disposed to avoid second-grade; but so long as some large houses advocate second-grade rabbits being packed others will be obliged to pack them also.

Large quantities of second-grade rabbits, however, must effect the value of first-grade in the English market.

With reference to poultry. In order to ascertain the character of the goods, the manner of packing and general get up, Mr. Lance was authorised to obtain some cases of American fowls and Russian ducks in London, and forward same to the Government Cold Stores, Sydney. On the arrival of these frozen products they were placed on exhibition at the Stores for the inspection of poulterers and exporters; Mr. Bradshaw made an exhaustive examination of the goods. Interesting articles have been written by Mr. Bradshaw on the subject of Poultry for Export, and published in the *Agricultural Gazette*. Articles were also written by him on the Cold Storage of Fruit, and other matters pertaining to his work. These articles have been eagerly sought after, and as many are now out of print, especially in reference to leading varieties of poultry, that a new series up to date are now in preparation.

In concluding his report, Mr. Jackson makes mention of the fact that Mr. Inspector Bradshaw and Mr. Higgs, storekeeper, contributed largely to the successful working of the Stores and ensuring satisfactory business.

A London firm gives the following particulars of British rabbit imports :—

FROZEN RABBIT IMPORTS for 1899, 1900, 1901, 1902, 1903, and 1904.

	1904.	1903.	1902.	1901.	1900.	1899.
			AUSTRALIAN.			
January ..	4,596	6,178	1,939	544	10,196	563
February	8,583	7,540	2,541	12,058	9,857	1,572
March	6,589	36,763	18,157	8,117	17,325	9,910
April	17,461	35,520	19,800	13,193	7,076	15,021
May .. .	23,452	21,446	24,025	9,492	79,697	17,367
June ..	6,009	13,985	6,807	4,650	18,360	10,647
July	1,623	10,978	12,461	20,706	12,412	30,227
August .. .	58,328	52,927	47,211	21,355	15,314	14,288
September	111,868	49,097	83,664	21,911	41,603	28,807
October . ..	106,090	48,925	41,949	34,298	53,462	41,930
November . .	45,690	36,024	12,684	22,447	33,013	......
December .	21,864	7,517	12,723	1,161	1,270	1,578
	412,153	326,900	283,961	169,932	299,585	171,910
			NEW ZEALAND.			
January	8,902	14,502	18,170	25,094	44,415	......
February .. .	741	9,266	8,404	.....	16,104	4,772
March .. .	.. .	117	......	885	7,482	....
April	657	3,363	933	559	1,756	......
May . ..	......	1,364	600	....	4,597	.....
June .	50	6,239	8,471	1,230	9,609	9,793
July ..	2,550	19,843	12,899	19,190	21,168	17,877
August .. .	17,767	31,685	20,282	42,793	14,488	16,403
September	45,064	19,274	33,437	....	68,569	16,289
October	15,536	.....	39,527	83,109	48,031	48,130
November	34,794	74,438	28,615	11,014	23,521	14,496
December	11,387	6,725	23,428	16,285	42,732	39,516
	137,448	186,816	194,766	200,159	302,482	167,276
			TASMANIAN.			
January	984	.....	...	.....	....	.....
August	9,000	......	.....	.....	....	...
September .. .	7,471	......	.. .	.....	..	.....
November	10,001	20,113	. ..	......	.....	......
December . ..	7,496	5,000	......	....	....	......
	34,952	25,113	......	.....	.....	....

The Passion-fruit.

W. J. ALLEN.

ALTHOUGH this fruit is not grown so extensively as it should be throughout the many districts on the coast, where it will do well, it nevertheless plays quite an important part in some of the young citrus orchards in the county of Cumberland, where it is frequently planted among the trees, and, as it begins to bear very early, growers are enabled to make considerably more from this crop than pays for the working of the orchard until the young trees begin to produce crops of fruit, which they invariably do after the third or fourth year.

Generally speaking, the vines are most productive before having attained to four or five years of age, after which period they begin to lose vigour and gradually die out, or cease to be very profitable, and are in consequence removed, and the trellis and wires which were used for their support are removed from among the trees, and in many instances are used for a similar purpose in a new portion of the orchard which the grower may be planting out, as a great number of growers who possess fair-sized holdings are continually clearing more land and increasing the size of their orchards.

The passion-vine is found to thrive well on many classes of soil—some so poor that one is led to wonder how anything could be profitably grown on it. On the light sandstone and poorer coastal country there is no other fruit which will give the same return as this, and with proper working and heavy manuring, it is wonderful the amount of fruit that can be taken from an acre of such vines. The area planted is comparatively small, and, in consequence, the fruit usually commands very high prices. As an addition to a fruit salad there is no flavour that can surpass it, and when eaten with cream it rivals the most delicious of strawberries. If this fruit were known in Great Britain and America, I venture to say that there would be an unlimited demand for it, if once we were successful in landing it in those countries in large quantities.

Some few years back a few cases were packed and exported, arriving in London in good condition, but somewhat shrivelled, and, in consequence, when put up at auction were sold at a very low price, owing to the fact that the trade did not know the fruit, and imagined them worthless, owing to their shrivelled appearance. Later on, however, a gentleman from Australia seeing them, introduced them among some of his friends, who thereupon bought them readily at a high price per dozen. However, at the present time the supply is not equal to the demand, and in my opinion if twice the quantity were grown it would command good prices.

In selecting a site for the planting of a vineyard, one of the important points to keep in view is to avoid a district or situation where frosts are at

all severe or of frequent occurrence in the winter, as there is one thing which this vine will not stand, and that is severe frosts, and the Easter, winter, and spring crops are those which are in most demand. During the summer time there is a superabundance of other fruits, and hence the consumption of the passion-fruit is not so great, but from Easter until Christmas time there is a splendid market for all well-grown fruit, and it is during part of this time that we have our coldest weather, and a severe frost or two would destroy the whole crop, and in all probability kill the vine back to the root.

The next point of importance is to put the land in thorough order before planting, and in places where it is very sour and deficient in lime, which it mostly is on our coastal country, where the passion-fruit is grown, it would be advantageous to give the land at least half a ton of good lime to the acre.

Fig. 1.

In raising or purchasing young plants, either secure the seed from the very best fruit which has been raised on good, strong, healthy vines, or buy plants from a reliable person who has been most careful in his selection, and in this way avoid, as far as possible, starting the vineyard with plants which might perchance have any hereditary weakness.

The trellis on which the vines are to depend for support might with advantage be erected just before the vines are planted, as by so doing the poles or stakes up which the vines are to climb until they are firmly fixed to the wires overhead, might be placed in the hole in which the vine is planted, and the top of same secured to the wire at the top.

In erecting the trellis, the posts should be 6 ft. 6 in. long, firmly set to a depth in the ground of 18 inches, and placed at distances of about 24 feet apart, or at furthest 32 feet in the row. On the tops of these posts are tightly stretched, at a distance of 6 inches apart, two strong No. 8 galvanized-

iron wires. The young vine is trained with a single stem up the stakes until it reaches the wires, when it is allowed to threw out from two to four leaders, which are trained to run either way on the wires. (See Fig. 1, which is a vine showing first summer's growth.) As the vine puts forth further growth, the main leaders and laterals are trained along the wires, and after the second summer's growth it presents the appearance of Fig. 2, which it will be observed is carrying a heavy crop of fruit.

Manuring.—Without judicious manuring there are very few districts where the growing of this fruit would prove highly satisfactory, while, on the other hand, those growers who are giving the most attention to this important adjunct are the ones who are making the greatest profits out of the industry. It has become a recognised fact that liberal dressings of manure must be used from the time of planting until the plants cease to be productive, as, generally

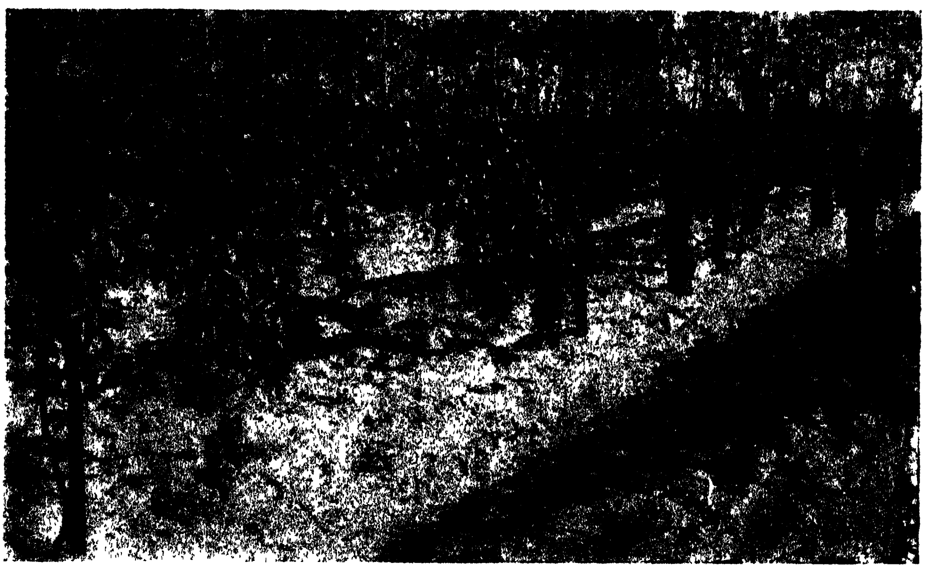


Fig. 2.

speaking, the stronger and more vigorous the vine the sooner it begins bearing, the better are the crops, and the life of the vine will be prolonged, and naturally the plant will be more healthy than if poorly nourished.

On making inquiry among the different growers I found that scarcely any two of them were using the same mixture. Some, on the lighter soils, were using considerable quantities of blood and bone with a little potash, others were using bone, superphosphates, and potash, while others were using a mixture of nitrate of soda, dried blood, superphosphates, and sulphate of potash, &c., &c., and judging from the appearance of the different vines, all with very gratifying results.

I have just returned from a hurried visit of inspection of a few of the vineyards in the Kenthurst, Glenorie, Dural, and Galston districts, but owing to the fact that it rained heavily most of the time, I was unable to visit as many as I had hoped to do.

The first place I called at was that of Mr. Wrench, at Kenthurst, who has always been a large grower of this fruit, and I found his vines looking well, and carrying fair crops of fairly well-developed fruit. I also visited a vineyard which had only been planted a few months, and here the vines were in a most healthy and satisfactory condition. At Mr. John Taylor's, at Glenorie, I found the same state of affairs, both the young and old vines were looking splendid, showing that the pruning and working had been well done, and manures had been liberally used. There was also a portion of his vineyard on which the vines were first planted some fourteen years ago. The first planting worked themselves out, and after the land had been allowed to lie idle for two years, it was again planted with vines, and although that was some five years ago, they are at present carrying a satisfactory crop. This goes to show that, with proper attention, land can be planted a second time,

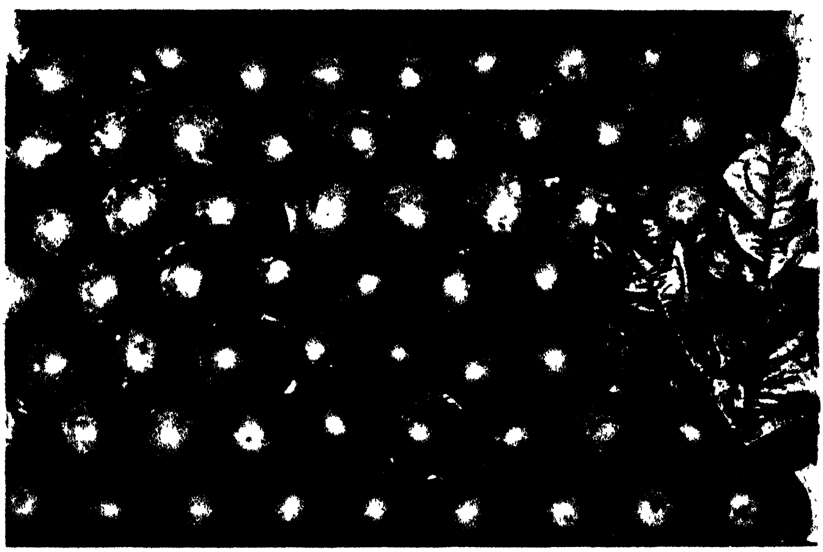


Fig. 3. Case of Passion-fruit Packed for Market.

and made to produce good crops, but I consider that during the time elapsing between the destruction of the old vines and the planting of the new, *e.g.*, there should be a crop of grey field peas or tares grown on the land, and turned under as a green manure, to assist in bringing the land back into good condition.

Mr. Maurice Brown, of Galston, was also planting a piece of land for the second time to vines, but they are too young yet to be able to say anything definite about them.

I next visited Messrs. W. and S. Fagan's different plantations, as these gentlemen have several in different parts of Galston, Dural, and Arcadia, and here I found some splendid young vines coming on. In one piece there were 11 acres, which had only been planted just before Christmas, and most of the vines were already well up on the wires, and many of them carrying a few splendid specimens of fruit. Their older vineyards were looking most healthy,

and carrying good crops. I also called upon Mr. S. Moore, junior, of Dural, who has also two or three vineyards at Castle Hill, and here again I found some of the very best and healthiest vines I had seen, and carrying splendid crops of fruit, all of which was of the very best quality. To this latter gentleman I am indebted for the box of fruit which is shown as a packed case in Fig. 3.

I passed many other good, healthy vineyards which looked as though they were well cared for, but time (and the weather) would not permit of my making an inspection of same.

There is no question that very creditable work is being done by the above-named gentlemen, all of whom show that they have a proper grasp of their work, and that they find fruit-growing in the Cumberland district a very profitable industry. Most of them are large growers of citrus as well as passion-fruit, and they keep themselves thoroughly abreast of the times, and are a credit to the fruit-growers of the State. There are many such growers throughout the same county who take a pride in their orchards and the quality of the fruit which they are able to put upon the market, and who, at the yearly balancing of accounts, find that their labour has not been in vain, but that the balance in the bank has been very materially increased.

Grading and Packing is carefully done. All badly-formed and inferior fruit is discarded, and the better fruit is mostly packed in layers, so that when opened at the markets it presents a good appearance. In grading, colour as well as size are taken into consideration, any badly-coloured fruits being sorted out and packed separately.

The quality of the passion-fruit grown in this State is all that can be desired, but the industry does not receive the attention it deserves, and growers might, with advantage, turn their attention more to the production of this popular fruit.

Lime Wash.

If glue is employed to give body, it is destroyed by the corrosive action of the lime, and in consequence the latter easily rubs off the wall when dry. This is the case if the lime is employed, as is often absurdly recommended, simply slaked in water, and used without any fixing material. Lime wash is prepared by placing some freshly burned quicklime in a pail, and pouring on sufficient water to cover it; boiled oil (linseed) should then be immediately added, in the proportion of 1 pint to 1 gallon of the wash. For coarser work, any common refuse fat may be used instead of the boiled oil. The whole should then be thinned with water to the required consistency, and applied with a brush. TEGETMEYER (Spon's Mechanics.)

Orchard Notes.

W. J. ALLEN.

JUNE.

THE rains which have fallen during the last two months have greatly benefited the orchards throughout the State, notwithstanding the fact that they are to a certain extent responsible for the citrus trees throwing out such a heavy full bloom and setting of their fruit which is not altogether desirable; they have given the citrus trees renewed vigour, and the main crop is filling out well, although in some places it is rather light, still there are many orchards carrying splendid crops of first-class fruit which will no doubt find a good market later on. A large proportion of the fruit is fairly clean, but during the last six weeks a little scale has begun to make its appearance, and this most of the growers are trying to clean from their trees, either by fumigating or spraying. The former treatment meets with the greater favour by many, as by the one treatment they are sure of cleaning their fruit.

The loquats have set a very heavy crop everywhere this year. Some growers are giving the trees a good application of manure and working well around them, but, in addition to this, it is most necessary to thin the crop, else it may be found later on that the fruit is so small as to be hardly worth while sending it to market.

Many of our growers are working around the trees during this wet weather. It appears to me that it would be much better to defer this work for six weeks or two months, as half the weeds loosened up with the fork-hoe are not turned under, and, owing to the moist weather, will grow again, and the same ground will have to be gone over again a little later on. If the ground is given a complete rest now, the weeds can all be turned under later on, and by keeping off it in the meantime it will loosen up and eventually be in better condition than when tramped and worked over while wet. Of course, there are large citrus growers who feel as though they must do some of this work before they have to start picking and marketing their citrus fruits, but there are many who can lay out their work so as to do it at the proper season, and when they will have to do the minimum amount of work to obtain the maximum results.

A meeting of fruit-growers was held at the Chamber of Agriculture on the 27th of April. There were very few growers from our colder districts where the apple is largely grown, but the majority of those present were in favour of a bill compelling all growers to destroy all fallen and infested fruit in which the fruit-fly will breed, and to bandage, spray, and remove from all trees, and destroy all fruit which the codlin moth attacks; but for the present,

owing to the sure methods at hand for the destruction of scales, they did not feel that it was necessary to have the latter included in such a bill. Also there was a majority in favour of a uniform case.

I do not think there is a State where greater attention is required to keep codlin moth and scale in check, and I think I am safe in saying in no other State is greater apathy shown for the fighting of these pests. There is no reason why we should import annually from 500,000 to 600,000 cases of green fruit if growers would grow good fruits and give them proper attention, but up to the present they have completely failed to fill the orders required by the local trade. I still maintain that we can grow fruit of as good quality for local markets or export purposes as can be grown in Australia, and I think that all those who have seen and tasted the apples growing at our Bathurst orchard will bear testimony to this fact. Care must be exercised not to allow the trees to grow too thick in the centre, else the fruit will not colour up as it should. It is only well-coloured fruit that finds the most ready sale at high prices either locally or abroad.

Many of our apple-gowers suffered severely from apple-scab last year. If those varieties which showed signs of this disease last year were given a little more attention, much of the loss caused by it might have been avoided; and although it is rather early to speak about treating the trees for this disease, I would like to see those growers who suffered, making proper arrangements to prevent a recurrence of the trouble this coming season.

Trees so affected must be thoroughly sprayed with Bordeaux mixture (winter strength) just when the buds are swelling; again as soon as the fruit is set, with a weaker solution of the same spray, to which has been added either Paris green or arsenite of soda.

In large deciduous orchards pruning may be commenced early this month; otherwise there is no hurry until the end of this month or beginning of next. This important work should not be neglected if growers hope to make the trees produce the most profitable crops. Judicious summer pruning, combined with proper winter pruning, will repay the grower handsomely for the labour incurred. Whilst on this topic of pruning let me again urge growers to head their trees well back at time of planting, so that the tree will carry its fruit from the base to the tips of the branches.

Many orchards would be greatly benefited by the application of lime, and the present is a very good time to apply same, so that it will have had time to act upon the soil before the spring manuring.

In frosty places, young citrus trees should be covered without delay, if the work has not already been done.

It is not imperative that cultivation should be carried on in the orchard this month.

Green manuring is claiming the attention of many of our fruitgrowers, and a good many have sown either peas or tares, to give this method a trial, in a portion of the orchard. This is a step in the right direction, and I predict that they will have no fault to find with this means of improving the soil when they see the results after one or two crops.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of June.

Vegetables.

This is the time of midwinter, cool in some parts of New South Wales, cold in some few places, and mild or even warm in others. It will, therefore, be apparent that it is practically impossible to write one set of directions to apply to the whole State, which enjoys such a variety of climates; frosts, snow, and ice in some of the elevated districts in the beginning of May, following, suddenly, quite warm weather. Here the growing of tender or half-hardy vegetables is a thing of the past, and further sowing must await until spring or early summer returns. On the other hand, in some favoured localities in the northern coast districts French beans, tomatoes, and potatoes can be grown the year round, but such localities are limited.

Wherever any portion of the land set apart for vegetables may not be required during the cold season of the year for cropping, it had better be dug up roughly, in order that as much of the soil as possible may be exposed to the weather. This should improve it to a considerable extent.

The present is a good time of the year to start the making of vegetable or flower gardens, and it would be advisable to perform the preliminary work as thoroughly as possible, for such a good chance is not likely to occur after the land has once been put under crop. Have the land trenched 2 feet deep, but avoid bringing up the subsoil to the surface, or there is likely to be trouble in store for the gardener, and it will take a considerable time, very probably, before the undesirable subsoil can be worked into a suitable condition for either vegetables or flowers. Of course, this does not refer to soils which are much of the same character from the surface to 2 or 3 feet or more below it. Such fine soils do exist in many places in the State, and when lying situated in suitable positions for the garden they should be made good use of. I have frequently seen instances where most excellent soil exists on farms close up to the residences, of which no use whatever is made for garden purposes, and the families enjoy neither vegetables, fruit, nor flowers of their own production.

Should it not be convenient, for some reason or other, to hand-trench the garden, do the next best thing if possible—plough, and then subsoil-plough the land; but no machine-work can come up to hand-work for garden purposes. The nearest approach to it is with the disc-plough work, but the disc-plough is not quite suitable for all kinds of soil.

After the preparation of the land, the subsequent work will probably have to be confined to hand-work, for when the garden is properly enclosed the area will be too small to admit of horse-work.

There are numerous handy implements, such as wheel hoes, with combinations for making furrows, seed-sowers, &c., which can easily be

obtained. If any such implement be used, it will be desirable to make the rows of vegetables continuous—for instance, instead of having, say, three or four short rows of cabbage, have one long one where practicable, or, if only one short row be sufficient for family requirements, plant or sow something else in the same line, and so on. In this manner the work of cultivation is straight-ahead, and there will be fewer turnings.

Artichoke, Globe.—Suckers or rooted plants may be planted out during the month, but this work is likely to prove most successful if it be postponed until the early spring. Plant at least 3 feet apart; 4 or 5 feet would be, perhaps, better. This vegetable is hardly worth the growing, but as some persons like it a plant or two might be tried.

Artichoke, Jerusalem —This species of sunflower is quite another thing to the Globe Artichoke, and is a very desirable vegetable to grow. When the tubers, which are somewhat like potatoes, are in proper condition, the leaves and stems wither away or die down. The tubers may be lifted and stored, or allowed to remain in the ground, to be taken up as needed They do not store very well, and are liable to decay. Keep enough tubers in the soil for next season's planting out in the spring. In suitable places the yield of this plant is sometimes enormous

Broad Bean.—Early plants should by this time be bearing pods large enough for use. Sow a row or two, according to requirements, at any time during the month. Gather the pods before the beans become over-large

Cabbage.—Plant out a small batch of strong seedlings, and sow a little seed in order to keep up a supply of young cabbages. A very little seed need be sown. Vast quantities of seed is wasted and seedlings raised in huge numbers at a time, but most of them are never made use of.

Endive.—A useful winter substitute for lettuce Sow a little seed. Plant out strong seedlings

Carrot.—Sow a little seed occasionally. Thin out seedlings well, and never allow carrots to become overcrowded, or to be spoiled by weeds.

Leek.—Sow a little seed in seed-bed, and transplant to shallow trenches when large enough—say, when the stems are half as thick as one's little finger; or when they are as one's thumb they may still be planted. The soil should be made very rich for the leek, which vegetable will need a good deal of moisture to enable it to grow to perfection When nearly full-grown the stems may be earthed up, in order to make them white and tender.

Lettuce.—Transplant young seedlings that seem large enough to stand the moving. Take up with a trowel after they have been treated to a good soaking with water, unless the ground may be sufficiently moist already. The less the roots are broken the better the young lettuces will grow.

Onion.—Sow a little seed occasionally, if a continuous supply be required. Attend well to seedlings which have appeared above ground, and keep down weeds without fail.

Parsnip.—If a large supply of this vegetable be required seed may be sown to any desired extent

Peas.—As this is one of the best vegetables anyone could grow, an endeavour to keep a supply going should be made. Plants well grown should be producing abundance of peas. The pods should be gathered whilst they are young and the peas tender and eatable. Do not allow any peas to ripen, and the plants will continue to produce much longer. Try several varieties. Sow as freely as you like.

Radish.—Keep a supply going by sowing a few seeds two or three times during the month. A very little seed is likely to suffice. Manure well with rotted dung. Cowdung will most likely prove to be the most satisfactory. Use the radishes whilst they are quite small and tender.

Mustard and Cress.—Sow a little seed now and then during the month. These salad vegetables can be kept going all through the year without very much trouble.

Herbs.—In warm localities all sorts of herbs may be planted, or old plants can be taken up, divided, and replanted.

Flowers.

Except in very cold places, deciduous ornamental plants may be planted about the garden. This is a good time for a general overhaul, useless plants should be taken out to be replaced by something better. Gardens are sometimes quite spoiled with half-dead plants, or by overgrown trees and shrubs. Clean away all rubbish, apply a good dressing of rotted farmyard manure, dig it in well and make ready for planting, either during the month or at any time until change of season.

The most generally preferred flower, and in most people's estimation the best, is the Rose, the universal favourite. Everyone with a garden should endeavour to make a good collection, and after planting look after the plants. Roses may be planted during the month or later still, but it would be as well to get the work of planting finished without delay. One of the prettiest of roses, pretty in all its forms from bud to the falling away of the petals, is Kaiserin Augusta Victoria, which is well worth growing. There is a climbing variety which may be even better to grow in some gardens. The flowers are the same as the other. Madame Caroline Testout is a beautiful rose also well worth having. This bears large globular pink flowers. Mildred Grant, Madame Abel Chatenay, Climbing Niphetos, Papa Gontier, Madame Jules Grolez, The Bride, Maman Cochet, Marechal Neil, The Meteor, Madame Hippolyte Jamain, Catherine Mermet, Ben Cant, Frau Karl Druschki (one of the most beautiful white roses in existence), Ernest Metz, Clara Watson, and Liberty, are all worth having; but there are hundreds of other good ones to select from. I have just planted out for trial (but my soil is of the most wretched description) many of the long-named new varieties which are said to be excellent. Some of these are:—Oberhofgartner Terks, Frau Lila Rautenstrauch, Gustave Gunnerwald, Grosserhzog von Oldenburg, &c. If the flowers turn out to be as marvellous as the names, I will make a record of them for general information.

Farm Notes.

Hawkesbury District—June.

H. W. POTTS.

Autumn departs with May. The mornings and evenings grow chilly, and frosts are not unseasonable. The past month was a busy one, and favourable weather prevailed throughout for getting in the main sowings of cereals. Those who were fortunate enough to have green summer crops to conserve had ample opportunity this season to fill their ensilage pits and tubs. A feeling of security exists always when this is finished, and the winter is entered on with haysheds full, and the ensilage going through the curing or fermentative stage.

The cold nights setting in point to the necessity for stabling the farm horses and dairy cattle. The tension of work is released from the paddocks, and attention has to be devoted to stall-feeding and housing the stock. The early crops of barley never looked better, and promise to give an early bite of green feed for the stock. This month both rape and turnips will be available, and all the early winter crops are in a vigorous and forward condition, pointing to a good stock season, with plentiful food supplies for spring.

Swedes, Turnips, Cabbage, Rape, and Kale.—These crops demand some attention, and, apart from cultivation to keep down weeds, the plants require considerable thinning to encourage sturdy growth.

Beans, Vetches, and Peas.—Calcareous or limey soils are best suited to the growth of these valuable legumes, and where this condition is not present in the soil, then it will be necessary to supply manure in the form of basic slag or superphosphate with kainit up to 4 cwt. per acre. As a rule peas are considered a risky and uncertain crop, but where they can be grown with a reasonable certainty of success, they provide a suitable crop in the rotation; failing this, then vetches may be sown with more confidence. Particularly on the lighter loams, the rape crops sown early in the autumn are well forward, owing to the suitable rainfall. The growth is luxuriant, and towards the end of the month will provide green fodder for sheep, pigs, and poultry, and when eaten off a second crop may be encouraged, provided the first be not eaten off too closely. It is quite possible to feed twenty sheep to the acre on some crops. It is as well to remember that sheep are kept in better condition when they have access to salt. Should it be found desirable to feed cattle with rape, then care must be taken to gradually accustom them to the change of diet, and, where the animals are in full milk, to feed them after milking. Sowings of Algerian oats, also Cape and skinless barleys, may be continued this month. Sweet potatoes should be dug up, cleansed and stored this month in sand for future use.

Arrowroot tubers may be taken up, boiled, and utilised for pig feed.

The sorghum crops will have to be finished this month, either as green feed for the pigs and cattle, or conserved as ensilage. A good opportunity exists now to convert it into stock ensilage. Onion seedlings from the early sowings may be planted out on rich well-drained and sandy soil, well manured with stable manure or a mixture of blood manure one part and superphosphate three parts.

Clarence River District—June.

T. WALDEN HANMER.

This month is suitable for planting out strawberries, a very delicious fruit that is not grown sufficiently in this part of the State

Anyone thinking of planting fruit trees, either citrus or deciduous, should prepare the land this month by subsoiling and an application of lime, as in this district planting should be completed by the end of July. Fruit growing on the Clarence is, generally speaking, haphazard, and I venture to suggest that farmers might pay a little more attention to an industry which, although it may not pay large profits, or which may in some cases be unprofitable altogether, on account of distance from suitable markets, would add very much to the comfort of the home both by the pleasure derived from eating the fruit and ornamentation of surroundings. It is hoped that next month the Department of Agriculture will make a start planting about 6 acres of orchard on the Grafton Experimental Farm, which will be an object lesson to those interested. The local market could at least be partially supplied by local growers.

Onions. Sowings of onions may be made this month. The following varieties can be recommended: —Brown Spanish or Brown Globe for market purposes, and Champion White Pickling for home pickling. This is a crop, too, deserving of more attention locally, as it is one that, as a rule, commands a high price.

Following is a list of some other vegetables that might be sown this month: Jerusalem artichokes, chokos, cauliflower, savoy, cabbage, carrots, turnips, parsnips, salsify, peas, broad beans, lettuce, radish.

A very useful garden tool, viz., the Hand-power Seed Drill and Wheel Hoe, should have a place on every farm or large garden. This is a little implement that can be bought for about 35s., and it is really wonderful how well it does its work and the amount of time and seed that it saves, and it dispenses with a great deal of thinning out and waste.

With regard to farm work, land that has been cropped should be cleaned up of all rubbish and weeds and ploughed, and if not required for the growing of green feed should be left fallow, and so allow all soft weeds, &c., to rot. Cowpeas and tares may be sown for green manuring purposes, to be ploughed in about August. For keeping up a supply of green fodder for the spring, sow oats, skinless barley, vetches and rape.

Riverina Notes—June.

G. M. McKEOWN.

Wheat.—When sowing has been unavoidably delayed owing to lack of rain having rendered it difficult to prepare the land, the work of sowing should be carried out without delay, in accordance with recommendations made in detail in May issue of the *Gazette*. The instructions therein supplied are based on practical experience gained at the Wagga Farm.

Barley.—As June is the last month in which barley should be sown for grain or fodder no time should be lost in sowing. Conditions may not always be suitable for the production of barley sufficiently well filled for malting purposes, but the following averages show that even if sold for fodder it will pay well to add this crop to the list of farm products, which should be as varied as conditions will permit. Farm yields :—

Golden grain	4 years	26 bus. 13 lb.
Chevalier	5 "	24 " 31 "
Kinver	4 "	27 " 40 "

The Skinless variety is the best for green fodder, as in the event of it not being all required for this purpose it may be made into hay in suitable weather, as it is free from beard. For green fodder sow three quarters of a bushel of seed, while for grain production half a bushel of good seed will be sufficient. Earlier in the season it is advisable to sow vetches with barley for green fodder, but June is too late for vetches.

Rape.—Should the season remain favourable rape may still be sown in land which has been brought into good tilth. The Dwarf Essex is the best variety, 3 lb. of which is sufficient to sow an acre broadcast. If sown broadcast the seed should be covered by harrowing lightly, or if the land has not previously been rolled the operation of rolling will provide sufficient covering. The cost of seed is from 9d. to 1s. per acre. Under favourable conditions the crop should be ready for regulated pasturage for pigs, sheep, or young cattle in about ten weeks. Care should always be taken not to turn hungry stock of any description into a rape crop, otherwise they may become blown. All stock, therefore, should be fed before being turned in, and then there is very little risk of injury. Stock should be removed before the crop has been grazed sufficiently to injure the crowns of the plants, as with care in this respect it will be productive for a considerable time under fair conditions. Where practicable, however, rape should be sown in March or April, as those months are more favourable, and by early sowing a longer grazing period is obtained before the plants run to seed.

Vegetables.—Transplant cabbage and cauliflowers into well worked beds, which have received a good dressing of stable manure. A small quantity (a tablespoonful) of Shirley's No. 3 manure will be found to give good results if worked into the soil where each plant is placed. In dry weather the plants should be watered as they are set out, and in these parts a good mulch of stable manure or horse dung collected in the paddocks will at all times be

profitable. For present planting the best cabbages will be St. John's Day, Early Drumhead, Sutton's Earliest, or Sutton's All Heart. Of cauliflowers, excellent varieties will be found in Asiatic, Early London, Burpee's Extra Early, and Burpee's Dry Weather. Peas may still be sown on a small scale for succession, but where water is available the area may be increased.

BATHURST DISTRICT—JUNE.

R. W. PEACOCK.

Field crops.—Sow oats, ryes, field-peas, and other varieties, black tares, and onic ns.

Vegetable garden.—Sow for main crop, peas, broad beans; make small sowings of lettuce, radish, spinach; sow in beds, for transplanting, cabbage and cauliflower; transplant cabbage, cauliflour, herbs, rhubarb, tree-onions, potato-onions, garlic, and eschalots.

GLEN INNES DISTRICT—JUNE.

R. H. GENNYS.

WHEATS for the main crop may still be sown in this district, but should be got in as soon as soil conditions will permit; the top soil should be lively and well worked for seed-bed. The double-disc cultivator—a machine with one row of discs following the other, the back row being capable of being adjusted to any angle required—is a splendid machine for cutting up rough clods, provided they are not too wet; it also covers seeds very well, and does not drag them about, like a harrow, which is always catching clods, weeds, &c. For broadcast sowing I recommend those who have the disc to try it, more especially the double disc cultivator.

From last year's experience here, the following wheats may be recommended for the northern table-land :—Bobs, Jonathan, John Brown, Nonpareil, Sussex, Nutcut, Plover, Tarragon, and Power's Fife (Manitoba); others, such as Lambrigg White Lammas, Cumberland, and Federation, are good wheats, but more liable to rust.

For *Hay Wheats* the Manitobas are the best; Nonpareil, White Hogan, Lambrigg White Lammas, Zealand, are also very good.

Barley may still be sown, either for grain or for green fodder. Some malting varieties, such as Albert, Eclipse, and Chevalier, are likely to do well.

Oats may be sown, either for grain or for hay. The best varieties are Tartar King, Surprise, Algerian, Potato, and Early Northern, for grain. Red Rust Proof, Algerian, White Tartarian, Ligomo, Danish Island, Pioneer, and Waverley, for hay.

Ryes may be also sown; Emerald being very suitable for green fodder. White rye is the best for collar-straw, &c.

Crown Lands of New South Wales.

THE following areas will be available for selection on and after the dates mentioned :—

H.S. or S.L. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
			FOR HOMESTEAD SELECTION.					
			a. r. p.		a. r. p.		£ s. d.	1905.
*970	Warren ..	....	734 0 0	2	352 0 0 and 382 0 0	Nevertire, 1 to 3 .	8 16 0 and 9 11 0	13 July
969	Windsor ..	....	173 3 0	4	40 0 0 to 46 1 0	Richmond, 10 to 13	0 5 0 to 0 5 10	6 ,,

* Available for "originals" only.

H.S. or S.L. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
			FOR SETTLEMENT LEASE					
795	Warialda .	Tulloona (partly).	....	1	4,283 0 0	Moree, 58	58 10 10	13 July
796	do .	Tulloona ..	23,737 2 0	6	3,725 0 0 to 4,932 2 0	do 44 to 52 .	42 13 8 to 58 10 6	13 ,,

FOR IMPROVEMENT LEASE.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
			EASTERN DIVISION.					
			a. r. p.		a. r. p.		£ s. d.	1905.
604	Albury ..	....	....	1	3,787 0 0	Gerogery, 7; Germanton, 11; Morven, 4.	47 6 9	Sale, 5 June
			CENTRAL DIVISION.					
1842	Coonabarabran.	Dennykymine.	....	..	6,680 0 0	Gilgandra, 50; Mudgee, 70.	27 12 6	Sale, 5 June

For Conditional Purchase.

Land District.	Name of Holding, &c.	Total Area. a.	r.	p.	Parish.	County.	Price per Acre. £	s.	d.	Date available. 1905.
Bellingen ..	....	40	0	0	Nambucca ..	Raleigh ..	1	0	0	6 July.
" * ..	....	1,000	0	0	Bonville and North Bellingen.	" ..	2	0	0	20 "
Bingara ..	Rocky Creek ..	530	0	0	Crawley	Murchison ..	1	0	0	20 "
Boorowa	....	94	1	0	Nurung ..	Harden ..	2	0	0	29 June.
Casino	Tooloom and Woodenbong.	40	0	0	Lindsay	Buller ..	1	0	0	29 "
Coonamble ..	Wingadee	1,520	2	0	Yarragoora.. ..	Leichhardt ..	1	10	0	22 "
Grafton	....	215	0	0	Elland	Clarence ..	1	0	0	29 "
" ..	....	1,140	0	0	Tuyarigo and Sherwood.	Clarence and Fitzroy.	1	0	0	29 "
" ..	....	45	0	0	Rushforth ..	Clarence ..	1	0	0	6 July.
Inverell	....	84	0	0	Nullamanna ..	Arrawatta ..	2	10	0	6 "
" ..	King's Plains	230	0	0	North Nullamanna and Swamp Oak.	" ..	1	0	0	6 "
"	Laura	217	0	0	Laura	Hardinge ..	1	0	0	6 "
Molong ..	Gonimbla ..	120	0	0	Murga	Ashburnham	0	11	8	29 June.
Mudgee ..	....	300	0	0	Boiga	Wellington ..	1	0	0	6 July.
Murwillumbah*	....	186	0	0	Berwick	Rous ..	2	0	0	20 "
Nyngan ..	Enaweena ..	80	0	0	Enaweena	Gregory ..	1	5	0	15 June.
Rylstone ..	.. ..	220	0	0	Goongal	Roxburgh ..	1	0	0	6 July.
" ..	.....	120	0	0	Umbiella	" ..	1	0	0	20 "
Stroud ..	......	860 620 370 2,340 6,140	0 0 0 0 0	0 0 0 0 0	Wangan, Kornga, Boranel.	Gloucester ..	1	0	0	18 "
Taree ..	....	70	0	0	Lewis	Macquarie ..	1	0	0	6 "
Tenterfield ..	Tenterfield & Boura Boura Creek.	400	0	0	Strathearn ..	Clive.. ..	1	0	0	6 "
Urana	Tubbo	316	2	0	Yanko	Urana ..	1	6	8	6 "
Wagga and Gundagai.	Borambola and Yabtree.	3,270	0	0	Yabtree	Wynyard ..	0	11	8	6 "
Warialda ..	Gineroi ..	8,180	0	0	Singapoora & Glass	Burnett and Murchison.	0	15	0	8 June.
"	" ..	785	0	0	" "	" ..	1	10	0	8 "
" ..	" ..	900	0	0	" "	" ..	1	13	4	8 "
Wellington ..	....	250	0	0	Guroba	Bligh ..	1	0	0	20 July.

* Available for "originals" only.

Conditional Purchase as Special Area.

Casino Land District, 258 acres 0 roods 23 perches, in parish North Casino, county Rous: maximum area, 71 acres; minimum area, 15 acres 3 roods 38 perches; price, £1 10s. per acre. Available for original conditional purchase only on 13th July, 1905.

Lismore Land District, 210 acres 2 roods, in parish Tunstall, county Rous; maximum area, 210 acres 2 roods; minimum area, 40 acres; price, £1 10s. and £2 per acre. Available 13th July, 1905.

Tamworth Land District, 80 acres, in parish Currabubula, county Buckland; maximum area, 80 acres; minimum area, 40 acres; price, £1 10s. and £1 15s. per acre. Available 15th June, 1905.

Tamworth Land District, 176 acres, in parish Moonbi, county Inglis; maximum area, 52 acres 3 roods; minimum area, 16 acres 3 roods 20 perches; price, £1 15s. and £2 per acre. Available for original conditional purchase only on 15th June, 1905.

(Signed) EDWARD MacFARLANE,
Under Secretary for Lands.

AGRICULTURAL SOCIETIES' SHOWS.

1905.

Society.	Secretary.	Date.
Hay P. and A. Association (Hay)	G. S. Camden ...	July 27, 28
Riverina P. and A. Society (Jerilderie)	Wm. Elliott ...	„ 25, 26
Corowa P., A., and H. Association	F. L. Archer ...	Aug. 15, 16
Parkes P., A., and H. Association	G. W. Seaborne ...	„ 16, 17
Murrumbidgee P. and A. Association (Wagga Wagga)	A. F. D. White ...	„ 23, 24
Forbes P., A., and H. Association	N. A. Read ...	„ 9, 10
Gunnedah P., A., and H. Association...	J. H. King ...	„ 22, 23, 24
Grenfell P., A., and H. Association	Geo. Cousins ..	„ 24, 25
Albury Annual Show	Walter J. Johnson	Sept. 12, 13, 14
Manildra P. and H.	E. J. Allen ...	„ 13
Wyalong District P., A., H., and I. Association ...	S. G. Isaacs ...	„ 5, 6
Northern Agricultural Association (Singleton) ...	C. Poppenhagen .	„ 13, 14, 15
Corowa P., A., and H. Association	F. P. Fawcett ...	„ 20, 21
Germanton P., A., and H. Society	Jas. S. Stewart ...	„ 20, 21

1906.

Albion Park A., H , and I. Society	Henry Tryer ...	Jan. 17, 18
Tamworth Agricultural Association	J. R. Wood ...	Mar. 27, 28, 29

[3 plates.]

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Agricultural Gazette of New South Wales.

The Tapeworms of Australia.

[Continued from page 318.]

N. A. COBB.

Tapeworms of the Dog.

(*Continued.*)

8. *Taenia echinococcus*, v. Siebold.—This, one of the smallest of tapeworms, is more common in the dog than any of the larger species. The total length, made up of only three or four segments, is 4 or 5 mm., while the greatest width is ·77 mm. Measurements in various parts of the body are as follows:—Neck, ·2 mm.; testicular, ·53 by ·79 mm.; ripe, ·77 by 2·4 mm.

The head is somewhat wider than the neck, and bears four suckers and a rostellum, surmounted by a double crown of hooklets, twenty-eight to fifty in number, which differ but little in size in the two rows, the larger ones being 30 to 38 μ long, and the smaller ones 18 to 30 μ. The bilateral genital pores, one to each segment, are located a little behind the middle of the margin. Each segment contains ovoïd eggs measuring 25 to 26 by 32 to 36 μ.

Fig. 26.—Life size illustration of a few of the worms.

From the Australian point of view, all other tapeworms of the dog sink into insignificance when compared with *Taenia echinococcus*. It is very common, and its injurious effects extend to a number of other domestic animals, and, what is vastly more important, to man himself. So far as the adult tapeworm itself is concerned, there is no evidence that it is very harmful to the dog. It is certain that the parasite is more common in stray and ill-conditioned dogs, but this fact can hardly be used to prove any baneful effects from the infestation, the poor condition of the infested dogs being possibly due to other causes. But hydatids, one of the forms of this tapeworm, which may appear in man, are justly feared, for though through the spread of knowledge concerning their nature and the means that may be adopted for their avoidance they are less common than formerly, they still play a prominent part among the diseases peculiar to sheep-breeding countries, and among them Australia. In fact, Australia has won a most unenviable notoriety through the prevalence of this disease in many parts of it.

Contemplating one of these worms, it is not without an amused sense of incongruity that one applies to it the name of "tapeworm." As shown in the adjacent figure, the worm is one of the smallest of all the tapeworm species, being a mere speck, too insignificant-looking to attract attention except under a lens. It is one of those species that mature rapidly, and shed the segments almost as fast as they are formed. Hence it seldom exceeds 2 or 3 mm. in length. Commonly it is composed of a scolex or "head" and two or three segments, of which only the last is large enough to be detected with the unaided eye. Even this is not the case when the segment becomes loosened from the worm and passes out with the excreta. Common as these little objects must be in the excreta of dogs in this country, it is improbable that the reader of these pages ever saw one, and it may be that careful search would reveal none to him, even where they are really abundant. This feature of the worm is one that is responsible for the prevalence, to a great extent, of the disease which it induces in the human body, for there can be no doubt that if the segments were large enough to be striking objects, they would, on account of their fatal significance, be regarded with such horror as to lead to much more active measures directed towards checking the spread of the disease.

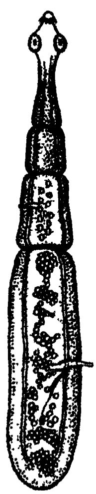


Fig. 27.—Enlargement of one of the worms shown in Fig. 26.
After Leuckart.

What the *Taenia echinococcus* lacks in size it makes up in numbers. It often happens that the cyst from which it is derived contains thousands of scolices or "heads," and that the majority of these, on being swallowed by a dog without mastication, as is the custom with dogs when eating soft flesh, give rise to tapeworms. In consequence it is not uncommon to find the intestine of the dog, when harbouring this species, to be almost literally swarming with them.

As the worms produce segments in rapid succession, and as these, becoming soon loosened from the parent stroma, pass on and out with the excreta, it follows that the segments are even more abundant in the excreta than the worms in the intestine. As we have before remarked, they are never seen on account of their small size, and more particularly because of their soft nature and inconspicuous colour.

Each segment produces many thousand eggs. These are, of course, wholly invisible to the unaided eye, as is always the case with tapeworm eggs. Their abundance about the haunts of infested dogs must be something startling. When the excreta become dry and are more or less quickly converted into dust, the eggs are spread broadcast by the wind. On the excreta becoming wet and dissolved in water they are liberated, and in this manner, doubtless, often find their way into sheep and other domestic animals, as well as into man.

The embryo, when it hatches in the stomach of a sheep or other suitable host, finds its way into the blood vessels. In this operation it is aided by the six hooklets, which are in fact its boring apparatus. Once in the circulation, it may take up its habitation in any part of the body of its new host. It is, in fact, found in the most various organs. In the lungs or liver most frequently, but not infrequently in the mesentery. It may choose, or at any rate grow to a cyst in, any of the following localities:—Wall of the intestine, the brain, under the skin in almost any part of the body, or even the bony parts of the limbs. From this it will be seen that hardly any part of the body is immune from the attack of the *echinococcus* embryo. Nevertheless it is especially in the lungs and liver, and more particularly the latter, that it is to be particularly looked for.

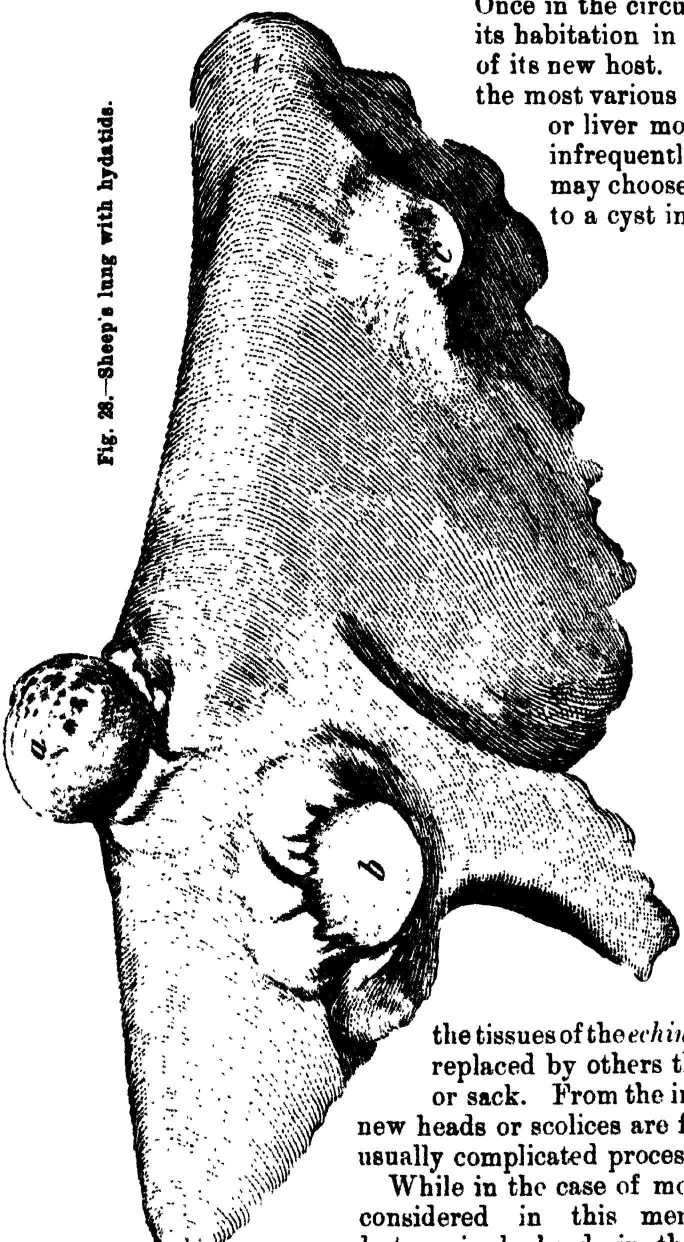


Fig. 28.—Sheep's lung with hydatids.

Here the embryo, having once settled down, completely changes its character. It looses its hooklets, as organs of no further use. These gradually disappear, and the tissues of the *echinococcus* embryo become replaced by others that form a hollow cyst or sack. From the interior of this sack the new heads or scolices are formed by a more than usually complicated process.

While in the case of most tapeworms hitherto considered in this memoir the cyst forms but a single head, in the case of the *Taenia echinococcus* the number of heads may reach hundreds, or even thousands. This is due to a process of budding, which gives rise to new sacklets, which in turn may repeat the process until the resulting heads constitute a veritable multitude. It would seem that this process of budding cannot go on indefinitely, for in

the end, as we know from the history of hydatids in human beings, the cysts break, and cause death or are absorbed, at least in part, the patient then recovering. It seems probable that the budding may be a provision against the stagnation that might ensue after the first sack has been formed if the intermediate host did not soon fall a victim to the carnivorous host of the tapeworm.

In the natural course of events the history of the tapeworm requires the regular sacrifice of the life of the intermediate host. Should this not occur the parasite is defeated in its object. We have here a curious subject for speculation. Applying the law of the survival of the fittest, now so widely accepted, we may reason thus: Sheep are the regular victims of the rapacity of the dog and allied animals, and this is the fundamental fact utilised by the parasite in its change of host. The tapeworm of the dog becomes the hydatid cyst of the sheep, which in turn originates the tapeworm of the dog. Should any infested sheep or other intermediate host become so wary or formidable as to escape the dog, the hydatid will go on growing to the extent of its budding capacity, and then die out in one of the methods we have indicated. The rupture of the hydatid, as we know from human experience, frequently results fatally. Now this is contrary to the laws that should control the survival of the parasite, for we may be sure that no organism "attempts" to compass its own destruction. So far as we can understand, it is the "object" of all organisms to survive. They "struggle," as the saying is, to exist. From these various considerations we arrive at the conclusion that the hydatid cyst is in essence a mild affection. When, however, its existence is prolonged beyond the time fixed for its life by the conditions under which it was developed, it becomes a malignant affection. This is the case with human beings at present. While formerly man not infrequently fell a victim to the wolf, that is no longer the case. Being still subject to the hydatid, through the agency of the domestic dog, he has become subject to the malignant form of the hydatid in place of suffering death at the maws of wolves, from which it will be seen that our latter state, bad as it is, is an improvement on our former.

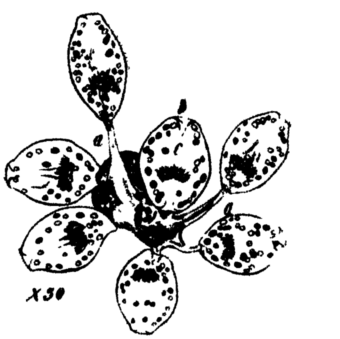


Fig. 29.—Group of scolices from one of the hydatids shown in Fig. 28.

While it is almost impossible to separate the medical aspect of the subject from the biological, it is not the intention of the writer to discuss the curative and surgical operations for the relief of hydatid patients that are of so much interest to most people in sheep-growing countries. They would be out of place in a journal of this character. We cannot, however, do otherwise than discuss those measures of sanitation that should be adopted to reduce the ravages of this parasite.

As is easy to see from the sketch of the life-history of the worm, its weak point, that is to say, the point at which it is open to attack by measures humanly devised, is its accessibility while in the intestine of the dog. Here it is subject to the influence of medicine through which it may be expelled, so as afterwards to be destroyed. It is morally incumbent on all owners of dogs, in a State like New South Wales, to periodically purge them and destroy the resulting excreta. It is easy to imagine the smile that will spread over the visage of many a reader of this recommendation, but that smile will never appear on the face of one who has had experience of this dreadful parasite. Nor will it excite a smile on our sheep-stations, where the constant menace of this parasite has for years been an evil shadow.

It is not possible to prescribe a dose that will be suitable for all dogs, and that matter had better be left to the local veterinary authority. The size and breed of dog, as well as the manner of its keep, are such variable factors that the dose varies within very wide limits. It should be used about once a month on all dogs that are allowed to run loose in such a way that they can pick up food unbeknown to the keeper. This applies above all to collies, used in connection with sheep, as they are manifestly most often responsible for the spread of the disease.

Fig. 30.—Half open scolex.

Of much more importance is the control of the dog's food, for if this can be absolutely and properly controlled, of course it will almost never acquire the parasite. It is, however, almost impossible to guard the dog on a sheep-station from contamination, and it would, therefore, be best to periodically supplement the control of the food by the use of purgatives.

The food that should be denied the dog, as far as possible, is that which may contain the hydatid cysts in an uncooked condition, namely, the lungs, liver, and other entrails of herbivora, notably those of pigs, sheep, and cattle. If one adopts the rule of feeding only cooked meat, the problem is easily solved. Any thoroughly cooked meat may be fed to a dog without fear of introducing the *Taenia echinococcus*. If any raw food is allowed it must be carefully inspected, for the parts of the body mentioned above are not the only ones that may contain the cysts of the *echinococcus*; almost any part may occasionally harbour them. In a country like Australia, all raw meat fed to a dog should, therefore, be carefully inspected for any unnatural lumps, and the same removed and destroyed, or the meat itself condemned and destroyed.

Another measure that can be taken against the prevalence of hydatids, is the regulation of dog ownership. Restrictions placed on such ownership, if wisely framed and executed, may be made to do a vast amount of good. The "restrictions" usually take the form of a dog-tax, and the associated registration by-laws. These are often municipal regulations. Such laws exist in this State, and are, beyond

doubt, beneficial. It may be doubted whether a more strict administration would not sometimes be warranted. It is difficult to believe that the public would not give the fullest measure of support to stringent enforcement of such laws.

Of late years there has been a vast improvement in the city of Sydney, so far as dogs are concerned. The writer well remembers his astonishment on his first arrival in Sydney, some fifteen years ago, at the number of stray dogs, mangy and otherwise diseased. His office was, at that time, located in Macquarie-street, and it was not an infrequent occurrence for him to count from a dozen to twenty such dogs, in walking the length of Macquarie-street, at about 8 o'clock in the morning. As this was one of the most exclusive streets in the city, it became a matter of wonderment what the condition of the city was as a whole. It turned out that the Macquarie-street waste-boxes of that day were more replete with the refuse that stray dogs seek than were those of some other parts of the town where the inhabitants were more economical, but, nevertheless, the number of stray dogs was everywhere great. Not long afterwards the nuisance became so great as to compel action, and the result was a most decided improvement. In this respect, Sydney now ranks with the best. In some of our country towns, however, the number of apparently stray dogs is higher than seems necessary, and in the country districts the number of useless dogs is too great for safety. The late Dr. J. D. Thomas, of Adelaide, who made a most careful study of the subject, estimated that 40 per cent. of stray dogs are infested with *Taenia echinococcus*.

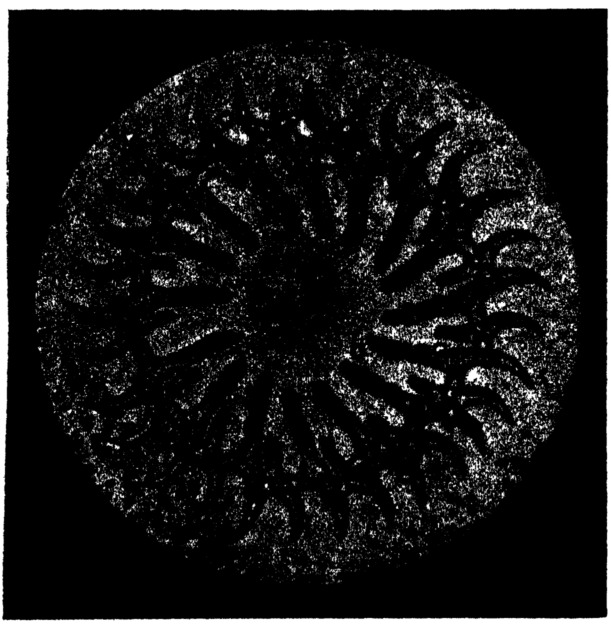


Fig. 31.—Hooklets from the head of *T. echinococcus.*

I do not happen to know of any records of the presence of the *Taenia echinococcus* in the dingo, but there is not the slightest reason to suppose that this wild dog does not harbour the parasite. If it does, the fact constitutes an additional reason for its destruction.

A very interesting observation, in connection with the *Taenia echinococcus*, was made by the late Dr. Thomas L. Bancroft, who, on the 11th of May, 1890, shot a forest wallaby (*Halmaturus dorsalis*), whose lungs were infested with the hydatid cysts of this species. The cysts were 1 to 1½ inches in diameter.

In a country like this, the ethics of dog ownership ought to be a subject of serious thought on the part of those who keep dogs. It would seem as though nothing short of absolute pecuniary necessity justifies the keeping of a dog in a country where sheep are so abundant as they are in Australia. As a matter of fact, probably the majority of dogs are kept as pets or companions. If one attempts to enumerate the ways in which the dog may be of economic importance, he does not muster a long list. We have the sheep-dog, commonly reckoned a necessity. Then there is the watch-dog, no doubt a useful animal in many cases, but of more than doubtful utility in many others. Next, we have dogs kept for breeding purposes, where the breed can be shown to be a useful breed. Hunting-dogs, where the same really contribute to earning a livelihood—very few cases in comparison with the number actually existing. So far as this State is concerned, this about completes the list, which certainly seems meagre enough. How many of our dogs would be justified on an actually utilitarian basis? Probably only a small fraction of those actually living in the State. Experience, however, shows that it is of little use to appeal to the ethical sense in such cases. The general good is best served by making the dog-license so high that no dog will be kept unless he is actually valued for some reason that will bear a fair money test, and then enforcing the law rigidly.

Unceasing effort should be made to instruct the public in regard to the danger of contracting hydatids, and the precautions necessary to avoid the danger as far as that is possible. The following notice, printed in large type and displayed in public places throughout the State by the Department of Public Health, is a notable example of this good work.

HYDATID DISEASE.

THE following suggestions for the prevention of hydatid disease are issued for general information.

J. ASHBURTON THOMPSON, M.D.,
Chief Medical Officer, President.

Department of Public Health, New South Wales,
Sydney, January, 1897.

HYDATID disease is caused when man or other animals swallow the eggs of a tapeworm which lives in the intestines of the dog.

These eggs are voided by the dog, with its excrement, in great numbers. They are too small to be noticed unless they are carefully searched for with a magnifying glass. After being passed they continue alive and capable of hatching for a long time, but they cannot hatch unless they enter the body of man or other animals by being swallowed.

When the eggs have been swallowed by man or other animals and have hatched in the intestines, they do not become tapeworms. The

embryos first bore their way to some solid organ of the body—to the liver, the lungs, the heart, brain, &c., and there they develop into bladder worms. These are what are called hydatids.

If parts of an animal which is infested with hydatids are eaten by the dog, the bladder-worms again become tape-worms in its intestines. Then the dog passes the tapeworm eggs, and this circle of life can recommence.

The minute eggs of the tapeworm of the dog can gain access to man so as to be swallowed by him in various ways. They can be washed by rain into streams, ponds, unprotected wells, &c., and thus may be swallowed with unboiled water; they can be blown about with dry dust and thus reach roofs, whence they may be washed into rain tanks, or they may thus reach and stick to articles of solid food; they may stick to vegetables which are commonly eaten uncooked—to lettuces in the kitchen garden, or to watercress in streams. The eggs also cling to the hair of dogs—about their bodies and about their muzzles; thus, if dogs are much handled, or allowed to lick the hands, or are fed at meal-times, the eggs may unconsciously be carried direct to man's mouth on his fingers.

Hydatid Disease is Preventable.

1. Try to prevent dogs from getting the tapeworm. Never allow them to enter slaughter-house premises, nor to eat uncooked offal, nor to pick up food as they stray about; feed them carefully at home. Keep them clean; groom them occasionally; do not allow them to make friends with strange or stray dogs. Regularly scald out their kennels and the ground round any place at which they are chained up; for, notwithstanding all precautions, any dog may acquire tapeworm, and the eggs are easily killed with boiling water.

2. Ownerless and useless dogs should be systematically destroyed. These pick up their food where they can, and are most likely to have the tapeworm. Cared-for dogs are often infected by stray dogs which have the eggs clinging to their coats.

3. Do not allow dogs to enter the house; do not allow them to play with children; never allow them to lick hands or face; never feed them at meal times, but always apart.

4. Prevent dogs from entering any water which may be used for drink by man. Never drink water from unprotected ponds or streams until it has been boiled; it is very likely to have been contaminated by dogs.

5. Keep dogs strictly out of the kitchen garden. Boil all vegetables before eating them; but if salads are required, wash them in running water (not in a dish) leaf by leaf. It is better to avoid salads taken from unknown or unprotected gardens.

As an illustration of the ignorance and skepticism that has to be combated, the following incident from the writer's experience may

serve :—Not very long ago a child died of hydatids, after an illness the details of which were very painful to hear. The bereaved family were friends of a female servant of mine, through whom the facts of the case were learned. She ended her narrative with the words, uttered in scorn and incredulity, "And the doctor laid it all on to the dog." It was incredible to her that a perfectly *well* dog had communicated a fatal disease to the child. Her skepticism was visibly shaken by my explanation of the matter. I learned afterwards, however, that the family continued to keep the pet dog.

It has always seemed to me that this is one of the subjects that might with advantage be occasionally touched on by the teachers in our schools, especially those in the country, where the danger is greatest. Unfortunately, the material to illustrate the facts of the case is of such a nature that it would be beyond the power of most teachers to convert the subject into an object lesson. Explanation and precept are practically the only resources.

From all that has been said, it will be very evident that one of the main points with regard to *Taenia echinococcus* is its bearing on the health of man. There is no reliable evidence that the tapeworm is very harmful to dogs, even when occurring in large numbers. The worm is so small and so short that the hold required to keep it in its place is not such as to cause it to bore deeply into the wall of the intestine. In all probability, therefore, the irritation caused by the use of the hooklets of the scolex is not great—not to be compared for an instant with that caused by the larger tapeworms of the dog. The great difference in this respect between *Taenia echinococcus* and the other species common in the dog is readily grasped by comparing with each other figures 23 and 30.

When we turn to the other domestic animals—those which harbour the intermediate form—we encounter a different state of things; but even here the matter is not so serious as it seems at first sight. A large percentage of the sheep and cattle of this country suffer from hydatids, and the cysts, it is true, are formidable-looking tumours; but it must be remembered that it is to the advantage of the parasite, up to a certain point, that these cysts or "tumours" should be of a mild character. It would be entirely against the interests of the parasite for the host to die early from the effects of these cysts, for it would thus lose the chance of being transferred again to the dog or wolf. From this it follows that except where the cysts are unusually numerous, they do not constitute a serious menace to the health of the host, except the latter arrive at a quite mature age. In the case of the sheep this seldom happens, as the animal is usually slaughtered before the time arrives at which the cyst would be a serious menace to health, except, of course, as before remarked, where the number of cysts is unusually great. This reasoning from the nature of the parasite is borne out by the examination of carcases and offal at the abattoirs. Animals in the best of condition not infrequently show these tumours in various organs. When it comes to older animals the case is different. In these aged animals tumours of large size, manifestly malignant in nature, are more commonly to be found.

With cattle the matter takes a similar turn, though in this beast as the age is greater, the evil is correspondingly greater.

With pigs the case is much as with the sheep.

In none of these animals, however, do we know the symptoms of the infestation with sufficient accuracy to guide us unerringly to the cause, and even if we did, it may be doubted whether any treatment that would be effective and economic would be within our power. The destruction of the infested is, perhaps, the most that could be accomplished. There seems little prospect that we shall make much advancement along this line in the immediate future. Our main line of action in the case of the domestic animals must, therefore, be directed against the parasite as it occurs in the dog.

With the human subject it is different. Here we know the symptoms of the most common forms of the hydatid with considerable completeness, so that medical treatment, and especially surgical treatment, of a high order of merit are at our service. However, this is not the place for the discussion of these, interesting as they are.

Habitat.—Intestine of the dog, where it may occur in thousands.

Tapeworms of the Horse.

Equus caballus, L.

Three tapeworms are known to me as parasites of the horse in Australia, *Anoplocephala perfoliata*, *Anoplocephala mamillana*, and *Anoplocephala plicata* (?). Of these the first, *Anoplocephala perfoliata*, appears to be the most common, and the latter, *Anoplocephala plicata* (?), the most rare. The number of individual worms found in a given host varies with the different species, the number being greatest for the most common worm. A single horse may harbour hundreds of *Anoplocephala perfoliata*, dozens of *Anoplocephala mamillana*, and only one or two *Anoplocephala plicata* (?).

All three of these tapeworms present similarities one with another, as will be at once seen on examining the illustrations. The form of the head and segments are much alike in the various species, while the genital pores in all three are found only on one side of the worm. *Mamillana* and *perfoliata* present the closest relationship.

As to the part of the intestine inhabited by the different species, it may be said that they have been found in all parts, but *A. perfoliata* is usually to be found in the caecum, *A. mamillana* in the middle part of the small intestine, *A. plicata* nearer the stomach. Though the number of instances in which it has been shown that these tapeworms are injurious to the horse are comparatively few, it is beyond question, in my opinion, that they are sometimes the cause of disease of a mysterious nature, or disease assigned to other causes. Unfortunately a correct diagnosis of tapeworm in the horse is not one of the easiest things a veterinarian has to attempt. It has sometimes been found in post-mortems of cases of peritonitis as well as in cases of paralysis that the cause of death was the presence of one or other of these worms. Either the intestine had been perforated with a resultant fatal peritonitis, or, as is surmised, the worms present in large

numbers had either by their actual irritation or by their toxic excretions brought on indigestion and anaemia followed by paralysis.

Nothing definite is known as to the intermediate host of any of these worms. It is certain that the intermediate host is an organism of world-wide distribution, as only such will harmonise with the corresponding distribution of the worms. It seems to me that the most probable species to act as intermediate host for these tape-worms are aquatic insects, crustacea, and leeches, but it must not be forgotten that the distribution of these latter is a difficulty to this theory. Some external parasite of the horse may be looked to possibly as a solution of the problem. Here the distribution question would furnish no difficulty.

9. *Anoplocephala* sp. (?).—I am not yet certain about the relationships of this species, collected by Mr. Perrie from a horse. It is of much larger size than the recorded specimens taken from the horse elsewhere, and in other respects it is divergent. No tapeworm over 80 mm. long is recorded from the horse, I believe, while the present specimen is over 250 mm. long, that is to say three times as long as recorded tapeworms from the horse. Its width too is in harmony with its length. In the widest part, namely at the posterior extremity, it is no less than 20 mm. wide. The number of joints is 330, so arranged as to give to the contour of the margin a bluntly serrate appearance. The massive head, which is separated from the body of the worm by a distinct contriction, carries four powerful suckers. Segments in various parts of the body give measurements as follows: Neck, 5·; testicular, 13 x 1·5; ripe, 20 x 1·2 mm. The genital pores resemble those of the other tape-worms of the horse in being all on one side of the segments.

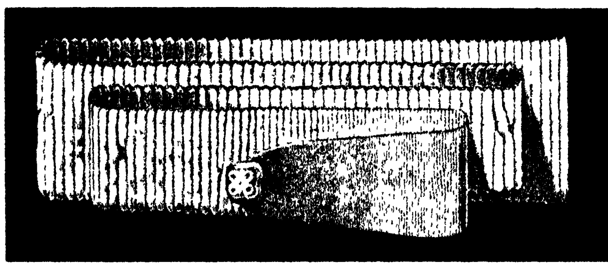


Fig. 32. Tapeworm of the Horse.
(*Anoplocephala plicata* (?).
Natural size.

Each ripe segment contains hundreds of thousands of thin-shelled eggs measuring 40–56 x 50–60 μ, the average being 51 x 57 μ. These eggs contain fully developed embryos measuring 16–20 x 18–26 μ, and averaging 19 x 23 μ. These embryos consist of a sub-spherical granular part to which is appended a transparent part having somewhat the form of the neck of a gourd. The measurements just given do not include this appendage. It is plain that the appendage is to one side only of the embryo, for it comes into view only in certain aspects of the egg. The embryos are supplied with six hooklets each and these appear to be about one-third as long as the embryos are wide.

The sexual pores are all on one side of the worm. Each pore is cushion-shaped and occupies the greater portion of the visible part of

the edge of the segment. It is noticeable that the pores are not placed on the extreme edge of the segment, for an attentive examination will show that they are invariably more toward one face of the worm than the other. This fact has a connection no doubt with the known lack of morphological equality of the two faces of the worm. Each pore may be seen, with a good lens, to have a rounded aperture.

The appearance of the sexual pores is shown on the upper margin of the specimen figured on page 629. On the upper margin of the illustration will be seen a series of minute markings along the extreme edges of the segments, so that the margin seems minutely doubly serrate instead of simply serrate as on the lower margin. When the pores are looked at face view they are seen to be round and to measure one-third of a millimeter in diameter. The margin of the segment appears in this view to bend towards the pore. In spirit specimens the margin is sometimes coloured with a black pigment.

A rather careful calculation of the number of eggs in one segment, made with the aid of a centrifuge and counting stage, gave as the average of three tests almost exactly 200,000. This is a degree of fecundity that we only appreciate when we recall that each worm has about fifty segments producing eggs at this enormous rate. It is quite safe to say that each full grown worm of this species contains 10,000,000 eggs!

10. *Anoplocephala mamillana* (Mehlis).—This is the smallest of the tapeworms found in the horse. It often reaches a size larger than that figured, but rarely exceeds 30 mm. in length. The greatest width is 3·4 mm., this width occurring near the head or in front of the middle of the worm. The small head is set off from the body by a distinct constriction, and behind it the segments begin to increase rapidly in size. The number of segments is 30 to 40, and these are so set together that the margin appears almost entire. The final three or four segments decrease rapidly in width, and of course increase correspondingly in length. Various segments gave measurements as follows: Testicular, 3·4 x ·5; ripe, 2·8 x 1·3 mm. Eggs removed from spirit specimens gave measurements as follows: 60–76 x 72–80 μ, averaging 66 x 77 μ. These eggs are thin-shelled and contain fully developed embryos each with a process as long as its own diameter. The main portion of the body of the embryo is spherical and is 20μ in diameter. It is rather difficult to see the hooklets of these embryos in spirit specimens.

Fig. 33. Tapeworm of the Horse.
(*Anoplocephala mamillana*, Mehlis.)
Natural size.

The sexual pores are along one side and are located a little in front of the middle of the margin of the segment. When protruded they appear as unusually conspicuous elevations, as high as they are wide, and having on a small scale somewhat the form of a broad coral polyp.

Each segment contains two to three thousand eggs.

Habitat.—Small intestines of the horse, where they occur in numbers up to five or six dozen in one animal.

11. *Anoplocephala perfoliata* (Goeze).—This is the commonest of the tapeworms of the horse, and is always found in the posterior part of the intestine, usually the caecum, less often the colon, rarely the small intestine. It is sometimes found in enormous numbers, but it appears that such instances are rare. Though nothing is actually known of the intermediate host from which the horse derives the cystic form, it may be fairly suspected that some small insect plays this part.

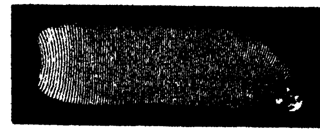


Fig. 34. Tapeworm of the Horse. (Large intestine.)
(*Anoplocephala perfoliata*, **Goeze.**)
Natural size.

The illustration gives a very good idea of the general appearance of this parasite. The striking appendages to the posterior border of the head serve to easily identify it. The worms are about 25 mm. long and up to 15 mm. wide in the widest part which is some distance in front of the posterior extremity. There are upwards of 100 segments, —125 in the specimen figured. The posterior segments, which are invariably narrower than those in the middle of the body, contain no eggs. The head bears four cup-shaped suckers and no hooklets. The suckers are directed forwards.

The eggs measure 68–80 x 72–88 μ, and contain embryos measuring 28–32 x 36–40 μ, and averaging 32 x 37 μ. The eggs average 74 x 80 μ.

(*To be continued.*)

Paspalum Dilatatum.

Mr. F. C. Dyer, "Jerrara," Marulan, writes:—"In the May number of *Agricultural Gazette*, I read an article on 'Paspalum dilatatum,' and with your permission should like to give my experience of it in this part. Some eight years ago Mr. H. J. Ramsey, Barber's Creek, gave me some seed of that grass, which I sowed on well prepared ground by the Jerrara Creek; but at that time none of it grew, at least I could not find any. Some five years ago I was walking through my corn crop when I saw a fine bunch of it some two feet high, of luxuriant growth, then found several other bunches, not so good. Since that time every particle has disappeared. It would not stand the droughts, and moreover is very late starting to grow in the spring. Some four years ago Mr. H. J. Ramsey gave me six roots, which I planted in very rich soil close by the creek. After planting, two died; the remainder is still alive, but does not make any headway; it has increased in size, but very little. In my opinion it requires plenty of moisture and very rich soil to do any good in this part, which it has not had, so conclude it is not suited for this climate, whatever it may do in warmer places."

Economic Entomology.

White Ants (*Termitidæ*), with Suggestions for dealing with them in Houses and Orchards.

WALTER W. FROGGATT, F.L.S., &c.,
Government Entomologist.

Since my monograph was published in the "Proceedings of the Linnean Society of New South Wales, 1895-7," a great deal of information has been collected, and observations made upon the species then described from Australia. In other parts of the world a number of new species have been described, and quite a boom has set in regarding the literature published regarding this previously neglected family. At the date of my publication,

Domed Nest.

Domed nest with outer wall removed.

Hagen's "Monograph of the Termitidæ of the World" was the only systematic classification of the termites of any importance, and our knowledge regarding their distribution was very limited.

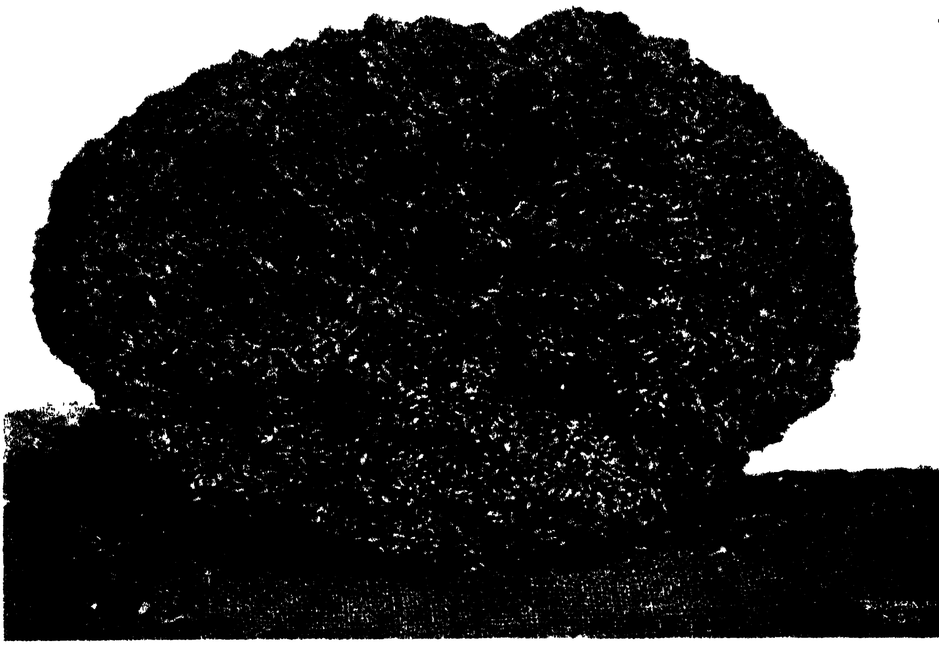
The economic importance of the white ant and its great powers for evil has led to a great deal of correspondence coming to the Department of Agriculture; so that I think that a general summary of the work previously done would be of value to all classes of the public, if written with few technical terms, giving suggestions for checking them, a general account of their habits, and the numbers known to infest this country. It is very unfortunate that the termites have become well known under the name of "White Ants," because, with the exception of their peculiar social habits, they are in no way related to the true ants (*Formicidæ*), which are their most deadly enemies, devouring them whenever they come across them. There is no family of insects on the face of the earth that do more damage to man's industry than the termites. From their countless numbers, subterranean habits, and insidious method of attack, they are very difficult to destroy. Always coming up from below, shunning the light, they work under cover, so that it is not until the damage is done that their presence is noticed. They can eat the centre out of a board or beam until it is as thin as paper, though outwardly perfectly sound until it is touched, when an accidental bump or blow will crumple it up into papery fragments and reveal damages beneath extending into unknown quarters all through the woodwork. In the orchard or garden, plants apparently healthy a few days before suddenly wilt and die. On examination, the stalk snaps off in one's hand, leaving a cavity on the butt; a few tiny yellow-headed creatures scuttling down into the roots remaining in the ground give the clue to the authors of the damage.

In Australia, many thousands of pounds' worth of property are annually destroyed by these insignificant-looking little creatures, and quite a number of instances in the City of Sydney have come under my notice of serious damage being done to public buildings; while in the suburbs they are a constant source of worry to property-owners, particularly on the North Shore line, where the land is comparatively high.

The whole of the roof of one of the largest rooms in the Australian Museum had to be replaced some years ago owing to the damage done to it by white ants. In the Department of Education's buildings in Bridge-street, the whole of the floor of the Records' room was perforated by these pests, and upon examination it was found that the termites had evidently been at work for years, great masses of earth having been carried up and packed between the joists. Within the last six months these pests have been found in the basement of the Town Hall. It is worthy of remark that in these three places recorded, Moreton Bay figs were growing close to the buildings, and it is quite possible that their head-quarters are in the roots of these trees; so that trees in a city like Sydney might form a regular home for white ants, and lead to them doing further damage.

In houses in the suburbs of Sydney it is not an uncommon thing to find the foot of the bed suddenly sink into the floor, where the white ants have come up from beneath and eaten out the wood.

In the course of my profession I have travelled over a great deal of the white ant infested districts of Australia, both along the coast and in the interior, as well as having a large correspondence with persons in all



White Ants Nest (*Coptotermes lacteus*) made in a bag of wheat.
Trangie, N.S.W.

parts of the country when collecting material for the determination of our species. This has since led to many questions and inquiries from brother naturalists interested in the subject in other parts of the world.

Prehistoric Termites.

As our fossil fauna in regard to the insect world is very limited and imperfectly known, we have no record of fossil termites; but in the fauna of the Old World they were very well represented, and quite a number have been described from Europe. Many of these have been obtained in amber (which is supposed to be the gum or resinous exudation of some prehistoric conifer), into which the fluttering male and female termites in their marriage flight, as they swarmed out of their nests in these ancient forests, fell and were entombed, passing down through the ages, the remains so perfect in every detail that at the present day entomologists are able to accurately describe them. Others fell into soft ooze, which, drying up rapidly, left the imprint of the tiny creatures long after it had hardened into stone.

In 1848, Professor Heer published his "Ueber fossile ameisen," afterwards translated and published in the "Journal of the Geological Society

of London" in 1850. In this were described several termites, among other insects, that he obtained from the Tertiary beds at Oenigen and Rudoboj. Four years later Dr. Hagen published a report in Germany, describing the fossil termites of the same locality, and pointed out that the climate of Europe must have been very much warmer at that period than under existing conditions to have supported such an abundance of insect life, for out of the sixty white ants alone, a third of them were known from fossils. Between 1855-60, Hagen brought out his "Monograph of the Termitidæ," in which he described all the species known to him or described up to that date; this was published in three parts in a German journal called the *Linnæa Entomologica.*

In 1861, Hagen recorded the discovery of three species in some Sicilian amber in the Oxford Museum. In 1878 Sterzel described a fossil species under the name of *Mixotermes lugauensis*, from the carboniferous strata of Lagau. In America, in 1883, Scudder recorded a number of new forms from the Florissant Tertiaries in his paper entitled "Fossil White Ants of Colorado." In this he described six new species, and gave a general account of fossil termites from other places.

In Brongniart's "Recherché pour servu à l'Histoire des Insects Fossiles," published in France in 1893, other fossil species are recorded.

Distribution generally.

Though England and the northern latitudes of Europe are free from termites, several instances have been recorded of their accidental introduction, chiefly by means of timber from tropical countries. McLachlan exhibited specimens, at a meeting of the Entomological Society in 1874, of a colony that had been discovered in the Palm House of the Royal Gardens at Kew, where they were kept under observation for some time before they were destroyed.

Three species are recorded from southern Europe, chiefly ranging along the Mediterranean sea-board, though one has been found as far north as Odessa, where it did a considerable amount of damage. *Termes lucifugus* is said to be an indigenous species, and has been well known in France from a very early date. In 1853 it appeared as a regular plague in Rochelle, where, not content with damaging woodwork, it found its way into the city archives, where it destroyed many valuable State documents. This species is found in all the southern provinces of France, and has been recorded from all southern Europe, Sicily, Sardinia, Morea, Turkey, Cyprus, Egypt, and Madeira. This is the species that has been monographed by Professor Grassi and Dr. Sandias, who studied them in Catania, Italy.

The second species, *Termes flavicollis*, originally a native of northern Africa, common in Barbary and Algeria, has been introduced into or has spread round the European coast, and is now found in most of the localities where the previous species exists.

The third species, *Termes flavipes*, a common North American form, has been found in the woodwork of the Bath House of Schœnbrun at Vienna, and was probably accidently introduced in timber from its native land.

The termites found in Africa have always attracted the notice of travellers, and Smeathman's account of the large mound-building white ant, *Termes bellicosus*, published as far back as 1781, entitled "On the Termites of Africa and other hot countries," contained the first authentic description of the internal structure of a termitarium, or white ants' nest. The notes and figures that he furnished have appeared in nearly all the popular works on Natural History up to the present time. This species ranges right round the coast of Africa. In Hagen's list, twenty species were recorded from Africa; but since its publication, Messrs. Haviland, Sharp, and others have added many new species, and Dr. Sjostedt, in his "Monograph of the African Termitidæ, 1900," brings the number up to seventy-seven species from the mainland, seven peculiar to Madagascar, and two in Mauritius.

Though most of the larger mound-making species seem to be more or less confined to the coast (as they are in Australia), as might be expected, as we approach the Equator the more numerous and destructive the species become. Nearly every explorer has had something to say about white ants in Africa. Paul Du Chaillu, the famous gorilla hunter, gives a general account of their nests and habits on the west coast in his book, "My Apingi Kingdom." Frank Oates, in his "Matabele Falls," notices them in that country, and figures one of the larger nests. Professor Drummond is sometimes quoted as an authority on white ants, because, in his "Tropical Africa," there is a chapter devoted to these insects; but there is nothing new in this, except the theory he originates that white ants take the place of earthworms in the tropics and improve the soil in the same manner; but this is open to much doubt.

The accidental infestation of the rock-bound isolated island of St. Helena is an interesting instance of the destructive powers of an introduced pest, and the way in which they can increase and multiply under altered or improved conditions. In the year 1840, a captured slaver was brought into the port of Jamestown, where it was condemned, dismantled, and the timbers landed in the town; these proved to be infested with a South American white ant (*Eutermes tenuis*) common in Brazil. These termites, escaping from the timber, became so destructive that several Royal Commissions were appointed to consider the best methods of dealing with them. Melliss, in his work on St. Helena, states that it was estimated that £60,000 of damage had been done by this introduced pest.

Little or nothing seems to be known about white ants in the northern or central portion of Asia; but in Crichton's "History of Arabia" they are said to be very destructive to young trees, which the Arabs protect by coating the bark with sheep dung. Two species are described by Hagen from Schiraz on the Persian Gulf, but beyond this I find no reference till

we come to India, where, in the southern provinces, they are very numerous and destructive, though there does not seem to be a great number of different species. The common species in Ceylon is *Termes taprobanes*, where it does an immense amount of damage; it has a wide range across to Borneo, Sumatra, and Java.

Haviland, in his "Observations on Termites: with descriptions of New Species," published in the Journal of the Linnean Society, 1889, lists and describes forty-six new species from the Malay Peninsula and Borneo, the latter being particularly rich in species.

Peel gives a general account in "Nature," 1882, of the termites of Assam, and Romanis notes those of Rangoon.

In the zoology of the Novara Expedition, Brauer described two species from the Nicobar Islands, and Forbes records them in his "Naturalist's Wanderings in the Eastern Archipelago, 1885," as being common in the Cocos (or Keeling) Islands, where he says they were introduced from the mainland.

In the Phillipine Islands, though few species have been described, they are evidently numerous, for Seoane has given a very interesting account, in the "Entomological Society of Belgium, 1879," of the destruction of a Spanish man-of-war by *Termes dives* while lying in the port of Ferrol.

Doderlein has described a species from Japan, and according to Dr. Knower, the American, *Termes flavipes* has been introduced and is firmly established in that country. I have no records of described species from New Guinea, but D'Albertis notes them as common on Yule Island. No one seems to have collected termites on the islands of the Pacific: but among collections from the New Hebrides, I have had several winged forms of an undetermined *Calotermes*, and *Calotermes longipennis* from the New Hebrides. In the Insect Fauna of Funufuti ("Memoirs," Australian Museum, Part II), Rainbow notes an introduced species on that island.

In the Hawaiian Islands Blackburn collected two species, both introduced from America, and Perkins, in the *Fauna Hawaiiensis*, says that *Calotermes castaneus* is found in the heart of large forest trees, and *Calotermes marginipennis* is the one destructive to wooden buildings in Honolulu.

As might be expected, South America is rich in termites, and as so many capable naturalists have spent years collecting in the tropical forests. the fauna is well known. Hagen listed twenty-seven species, some of which had been collected and described by Walter Bates on the Amazon. Dr. Fritz Müller has contributed largely to our knowledge of the termites found in the Santa Catherina district, in working out their life histories.

Recently Dr. Silvestri has monographed the South American termites, classifying the species previously described by Messrs. Bates, Hagen, Müller, Wasmann, and Kollar, and adding about thirty new species, which brings the South American fauna up to about ninety.

They are well-known pests in most of the West Indies; Cuba has several species. Hubbard has described the habits of those of Jamaica, of which the tree-nest building species is the most common (*Eutermes ripperti*).

Maynard has recorded his observations in "Notes on the White Ants of the Bahamas" (Psyche, 1888) on those found in these islands. Moseley, in his "Notes by a Naturalist on H.M.S. 'Challenger,' 1894," describes them on the Virgin Islands. Hagen lists them from St. Domingo and St. Thomas; and Marshall studied the habits of *Eutermes destructor* in Antigua.

In Central America they are very destructive, and the country is alive with several species that, during the construction of the Panama Railway, did a great deal of damage to the rolling stock, even forming their nests in disused railway cars. Messrs. Dudley and Beaumont kept a number in captivity and observed their habits, notes on which were afterwards published.

Turning to North America, we find *Termes flavipes* is the common species all over the United States; but though it has been known for so many years, its true nest has never been discovered, as far as I can learn, up to the present date. Scudder has described their ravages in Florida, Buckley records two species in Texas, others are known in Mexico, and Osten Saken has studied their habits in California. In the Southern States along the Mississippi they often do a great deal of damage to tropical produce.

In 1879, Hagen described an immense cloud of winged termites that swarmed out at Cambridge, U.S., but they did not reappear the following season. The most northern limit of the termites in the New World is Manitoba, where *Termes occidentalis* was discovered and described by Treherne.

Distribution in Australia.

Three species of white ants were described from New Zealand, to which I have added another species, *Calotermes brouni*, after my valued correspondent, Captain Thos. Broun, Government Entomologist in New Zealand, who wrote, "This species originally inhabited the Puriri (*Vitex littoralis*) in our northern forests, where I have frequently cut out the nests containing only a small family."

Four species are recorded from Tasmania, and up to the issue of my monograph there were only six described from Australia.

Since this was written a great deal of information has come to hand that enables us to map out the distribution of the termites in the interior of the country and the western side of the continent. The members of the Horn Exploring Expedition, 1896, brought back several interesting forms from the McDonald Ranges, which were placed in my hands by Professor Spencer for determination. In the vicinity of Kalgoorlie, West Australia, my father collected a number of very interesting forms, many of them peculiar to that district, while his notes on their habits made his work exceptionally valuable.

The eastern coast-line of Australia is chiefly rugged forest country, and termites are plentiful; in southern Gippsland they are a well-known pest,

and northward in the Goulburn Valley (Victoria) they often damage vines and fruit trees in the orchards. In the north and north-western parts of that State they are more or less plentiful in the timbered country, but apparently never form nests of any great size. Coming overland in the South Coast districts of this State, we soon meet with the large dome-shaped nests of *Termes lacteus*, which is found right up the coast at intervals into southern Queensland; these nests are generally dotted over the flats, and

Nest of the Milk Termite *Coptotermes (Termes) lacteus.*
Barker's Creek, N.S.W.

though this species is common about Sydney in colonies, it seldom constructs a regular nest. Two species of *Eutermes* form nests up trees or on stumps about Sydney, and at least half a dozen other forms may be found in dead timber or under logs within a short distance of the town. The same state of things prevails as far as Newcastle, and for some distance farther north. Beyond Rockhampton they are plentiful, though the larger nests are not common; from Mackay, Turner collected five very distinct species.

Towards Townsville they increase in numbers, but, coming to the semi-tropical jungles towards Cairns, they are chiefly arboreal forms along the coast. From Cooktown, and all over Cape York and Thursday Island, the larger nests are very numerous, and form a striking feature of the landscape. At Somerset (Cape York) is to be found one of the most remarkable white-ant cities in the world. Viewed from the sea, and looking up beyond the old Government Residency, now occupied by Mr. Frank Jardine's homestead, it appears as if the plain for a mile or more in extent is covered with pointed pillars 6 to 7 feet in height, broad at the base, and tapering to the summit, forming regular symmetrical pyramids. They are thickly dotted over the plain, often only a few yards apart; the effect is much heightened if the grass has been freshly burnt off, as it had been the first time I steamed past Somerset.

Several writers have noticed this city of the termites. Mosely likens them to kiln chimneys; he says that it gives the country the appearance

View of White Ants Nests, Cape York.

Taken from "A Naturalist in Australia"; S. Kent.

of a pottery district in miniature, and states that many of them are 10 feet in height. D'Albertis, describing them, says: "Termites' nests, both on the hills and plains, measured often 10 feet in height and 13 feet in circumference at the base." He found, upon opening them, that many had been attacked, and often the termites almost exterminated, by large black ants.

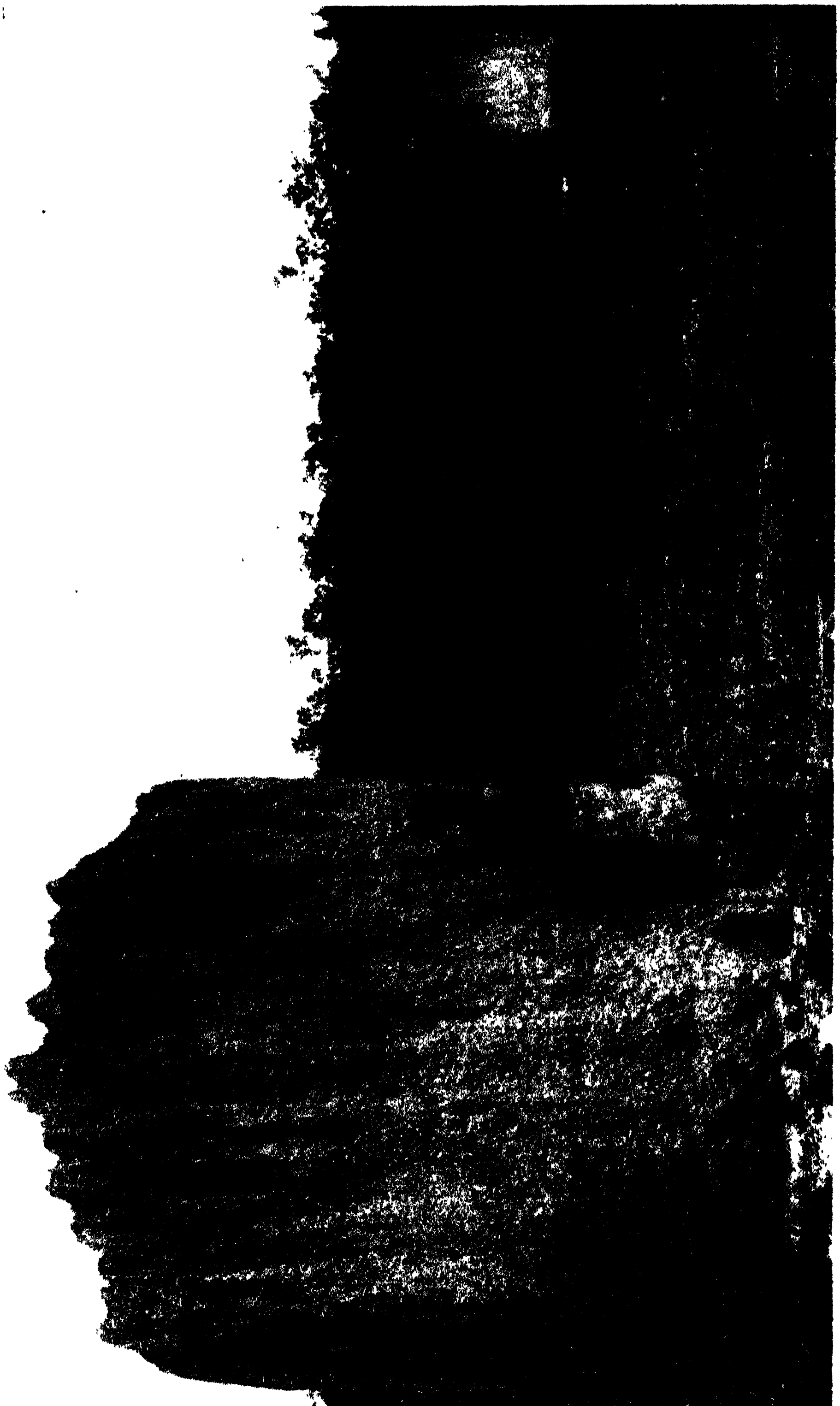
On Thursday Island, and many other islands round Cape York, the same form of nest is common. Turning down into the Gulf country and the watershed of the Flinders River and its tributaries is one of the most termite-infested places in the world. Nothing is safe from their depredations; stockyards, fences, and houses only remain intact for a few seasons,

in spite of all precautions. As soon as a branch dies it is attacked, and in many places no stumps or dead wood is left in the scrubby forests. On the table-lands everything is swept up, as it were, by these invisible gnomes, who, as forest scavengers, do their duty to perfection. If one cuts some grass for a bed, and leaves it lying upon the ground for twenty-four hours, anywhere on the Lower Flinders, it will be cut up into fine chaff by the termites that have swarmed up from the ground beneath, attracted by the scent of the drying grass; and if one is inexperienced enough to leave his blankets upon the top of it he will find all the lower folds riddled with holes. All kinds of implements that had been left out in the paddocks, such as earth-scoops and waggons, on the Cambridge Downs Station, were brought in with the felloes of the wheels (hard, seasoned timber) gnawed to a shell; while the storekeeper had to be continually turning over his stock, or he would find the large white termite (*Termes errebundus*) boring galleries through rolls of mosquito nets, books, and boots, and making nests in the cart-saddles. They made their way into the cases of jam and tinned meats, carrying the clay in between the tins, and causing them to rust and spoil the contents. At a hut on this station where I used to camp, the sides were built of upright saplings of ti-tree, about 6 inches in diameter; the termites, coming up from below, had eaten out the centre, reducing most of them to pipes of bark. In the silence of the night I have lain awake listening to the millions of tiny jaws gnawing at these timbers, voices of the night as strange and uncanny as one could well imagine.

Nest of the Spinifex Eutermes
(Eutermes triadiæ.)
Hull's Creek, Kimberley, W.A.; 14 feet high.

Past Normanton onwards to Port Darwin we are still in thickly-infested country, and about 10 miles out of Palmerston find some of the tallest ant-nests in the world. In the same district are also found the magnetic nests, remarkable for always pointing north and south.

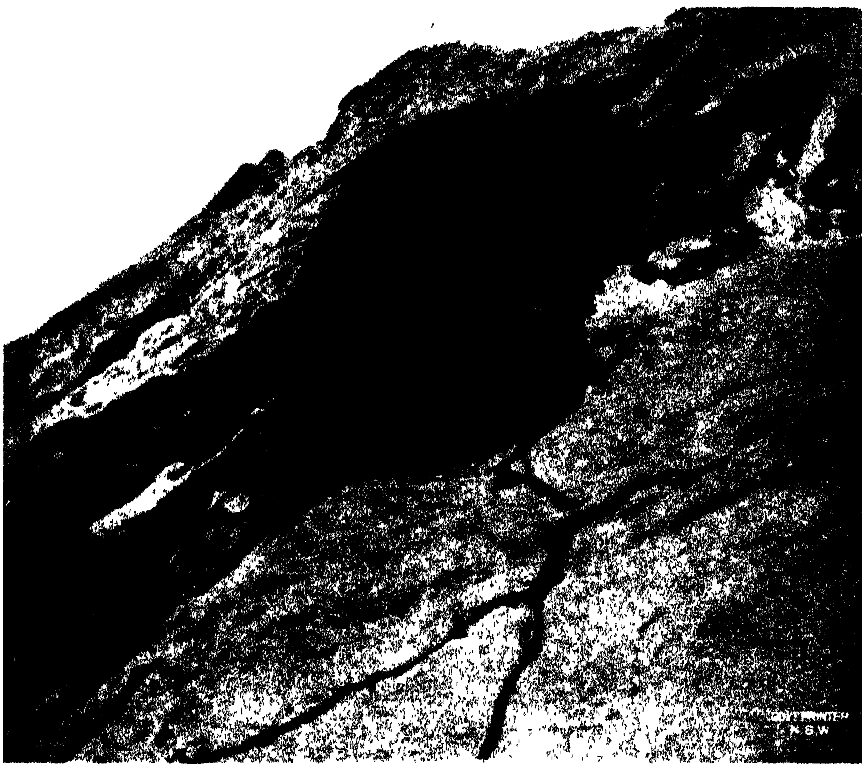
In that portion of north West Australia stretching across from Cambridge Gulf to Roebuck Bay, known as the Kimberley district (where I spent twelve months), and probably as far as the De Grey River, all through the open forest flats and along the edge of the sandy "Pindan" country, are found numbers of large, broad nests, from 5 to 6 feet in



Nest of the Magnetic White Ant *(Termes meridionalis.)* Near Palmerston, Port Darwin.

height, constricted at the base, but swelling out on the sides in rounded masses, on the sides overlapping each other as additions have been made to the main portion, while the summit is broad and rounded, giving them a somewhat irregular mushroom shape, which are figured by Saville Kent in "The Naturalist in Australia."

I have no record of the absence or otherwise of termites on the large tract of treeless country stretching round to North-west Cape, but the



Nest of the Pale Coloured Entermes (*Eutermes fumipennis*) built on the top of a sandstone rock at Manly, N.S.W. The dark lines are covered galleries leading down to the ground.

smaller termites probably will be found in ground among the grass roots. The coastal districts of West Australia have not been examined for these insects, but, as before noted by my father's investigations about Kalgoorlie, and Spencer in the more central districts, we have a very good idea of the termites found in the interior.

Structure of Nests or Termitaria.

The nests of white ants may be divided up into a number of different groups, though the members of the different genera seem to form a more or less uniform plan of structure. Many species form no regular nest,

simply taking up their abode under a log or stone, and the queen and eggs may be discovered in turning over the sheltering log; others, we find, though constructing very elaborate nests in some districts, in other places, though belonging to the same species, simply hide in the fallen wood or burrow underground. Most of the turret nests, which will be described in the notes under the different species, have a well-defined clay wall or outer covering enclosing the true woody nest, and rise directly from the ground: in the first instance commenced over a log or stump, which is gradually absorbed into the structure and enveloped in the outer clay covering.

Arboreal Nest of the common Pale Eutermes
(Eutermes fumipennis).
Sampson Vale, Queensland.

The arboreal nests have no clay in their structure when any distance from the ground, but when close have an admixture of earthy particles all through the outer portion.

The Classification of Termites.

Most of the earlier entomologists, when treating of white ants, placed them under the order *Neuroptera*, or at best formed a sort of halting-ground between the *Orthoptera* and the former under the title of *Pseudo-Neuroptera.* Others have followed Dr. Packard, and included them in his new order *Platyptera*—flat-winged insects, in which he placed them together with the *Psocidæ* and *Perlidæ*, with which, except in the shape of the wings, they seem to have very little in common.

Among the very earliest forms of insect life in the primeval world, insects allied to *Neuroptera* and *Orthoptera* seem to have been most prominent, and cockroaches and white ants, so closely allied to present

existing species, have been found, so that there has been no difficulty in classifying them.

If the structure of the wing is to be taken into consideration, there can be no doubt that the discovery of the giant termite from Port Darwin—*Mastotermes darwiniensis*, described by me in the "Proceedings of the Linnean Society of New South Wales"—brings them almost into touch with the family *Blattidæ* (cockroaches). Termites under some circumstances look so like earwigs that one of our greatest authorities on the *Neuroptera* actually described a supposed "wingless termite" from Japan under the name of *Hodotermes japonicus*, but in the following volume appeared a note from the author stating that he had discovered, upon comparison with a Japanese *Forficula*, that his new species was a damaged earwig. Dr. Hagen says, in the "Proceedings of the Boston Society of Natural History, 1868," the three families *Termitina*, *Blattina*, and *Forficulina* are co-ordinated and very nearly allied.

Minute anatomical details may bring them into line with some of the *Neuroptera*, but on the comprehensive grounds that all the large divisions of insects were classified upon, into what are known as Orders, the outward structure has been taken as the standard, and they take their group-name from the form and structure of the wings. Now, the termite wings are much more like straight wings (*Orthoptera*) than lace wings (*Neuroptera*); those of the genera *Termes*, *Eutermes*, and allied groups being even more primitive in their venation than the more specialised *Mastotermes* and *Calotermes*.

In their metamorphoses a baby termite undergoes only a gradual change, like the little cricket or grasshopper—an active-feeding creature from the time it emerges from the egg, till, by successive moults, it gradually reaches its full size, and with a final casting of the skin comes forth a perfect worker, soldier, or winged white ant. There are no abrupt changes from larva to pupa and pupa to perfect insect as we see in the lace-winged flies.

The life of a termite's nest is most remarkable from the very distinct forms or casts of insects that are produced from the same eggs with no apparent treatment of the baby larvæ in their upbringing (though it may exist, as the different feeding of the bees produce the queen bees). The founding of a termite city has been told in my "Nature Study," published in the *Agricultural Gazette*, N.S.W. (1903), so that only a brief recapitulation is necessary here. When the swarms of winged males and females are ready to emerge from a termitarium, the workers cut slits through the solid clay walls, which the soldiers guard until a suitable time, generally late in the afternoon, when they withdraw, and the winged creatures swarm out in a continuous stream, flitting along with their loose fragile wings, and swarming round the lighted lamps in the early summer evenings, where they are well known under the name of "Flying-ants," and drop their wings all over the place. Out of the millions that swarm out of a single nest, perhaps only half-a-dozen couples

may survive their many enemies and found a fresh colony, for Nature is very lavish in her superabundance of life. The typical winged termite is dark brown or yellowish, with a more or less rounded head, with many-jointed antennæ, the segments of which are bead-like in form and fringed with fine hairs; the eyes are large and well developed, and most species have simple ocelli on the top of the flattened head, while the mouth parts beneath are hidden from view. The thorax is short and broad, attached to the head by a very short neck, and the legs well adapted for running about; the wings consist of two pairs, the front and hind ones, elongate and narrow, rounded at the tips, and when laid over the back reaching a considerable distance beyond the tip of the elongate flattened abdomen, which is round at the tip, and furnished with two short-jointed appendages called the cerci, or anal appendices. Th venation of even the most specialised forms is very simple when compared with the complicated network of veins observable in the wings of most insects, and most of them are opaque or blackish in tint; at the base of each wing is a curious cross nervure, which enables them to break off their wings when they have served their purpose of flying out from the nest, and would be only an encumbrance when they started housekeeping under logs or in the ground. The new nest is started by this pair, a male and female, popularly called the king and queen: and after copulation the female becomes gravid, and her abdomen becomes a mass of egg-tubes, increasing rapidly in size, until finally, while the rest of the head, thorax, and legs have remained the original size, the abdomen becomes a circular, sausage-like shape, white, with the integument so swollen that the closely-fitting bands of chiton that once covered the whole surface are so divided that they only form dark transverse bands. Here she remains for the term of her natural life, and, if belonging to a mound-forming species, the workers and soldiers of her species, who are always wandering about in small companies, and thus find the helpless pair, set to work to wait upon them, and form the foundations of a nest over and around them, tending the eggs as they are laid, feeding the larvæ as they are hatched, and finally, reinforced by them as they reach maturity, the first members of the small colony soon increase the size of the mound, and form a regular nest. What becomes of the prince consort after the queen is fairly started as an egg-laying machine I do not know; he does not appear to be necessary, and apparently disappears. I have never found one in the regular royal chamber in which the queen is installed in every well constructed nest, though writers upon some of the African species always mention the royal pair in the queen chamber. The nest is full of intermediate forms of larvæ from the size of a pin's-point of white matter to the almost fully-developed soldiers and workers, showing the structural difference of the head, but still requiring the final moult to be perfectly formed. The immature winged forms are easily recognised by the large soft bodies and rounded wing-pads standing out on the shoulders. After the royal pair we come to the soldiers and workers, which are sexless.

The workers are usually short and broad in proportion to the soldiers, have the head rounded, with similar antennæ to the winged form, but without eyes or ocelli, the large powerful jaws, which are responsible for all the damage caused by the white ant, hidden when viewed from above by the rounded upper lip. The thorax is short, with stout legs, and no traces of wings, with the segmented abdomen somewhat curved on the sides to the rounded tip. The soldier has the general appearance of the worker, but the head is usually larger or more elongated, with the jaws produced in front of the labrum or upper lip into a pair of sabre, sickle, or tooth shear-bladed jaws, which meet at the tips or can be folded over each other. While the legs and thorax are similar to that of the worker, the abdomen is usually smaller and more slender in proportion. The soldiers are sometimes almost as numerous in the nest and colonies as the workers; but in others you may find hundreds of workers to every soldier, probably because less protection is required in the underground nests. The soldiers act as the police or protectors of the colony, rushing from all quarters as soon as a break occurs, and holding the breach, until the workers can repair it with fresh clay, which they bring from the interior. It is on the workers that the whole economy depends: they tend the queen, remove and look after the eggs, feed the helpless pupæ, and do all the building and construction of the termitarium.

Though the queen is apparently the head-centre and sole source of life and reproduction of the countless multitude that inhabit the nest, we sometimes come across greatly-developed pupæ produced from the embryonic winged forms, though the wing pads have even become aborted, which for want of a better name, we call supplementary queens. I had twenty-two specimens sent me taken from a small nest in southern Queensland, and have frequently found two or three in a nest.

These supplementary queens have been noticed in other countries, and Dr. Müller, when working out the life histories of the white ants at Santa Catherina, Brazil, obtained thirty-one specimens in a nest.

Following up the relationship of the *Termitidæ* with the order *Orthoptera*, I think if we take the *Blattidæ* (cockroach) as the end of the order, followed by the termites and *Embiidæ*, they come very naturally together as two more families in the order, without running them into the *Pseudo-Neuroptera*.

Hagen, in his monograph, based his classification of the family upon the structure of the wings, ocelli, number of joints in the antennæ, shape of thorax, and tibial spurs, which I followed in my work on the Australian species. While the structure of the wing forms is very distinctive in defining generic species, it will be found that the study of the soldiers is one of the best methods of defining the species, and these differences are constant; when sometimes it is very hard to point out the difference between two species in the perfect-winged form, even when the soldiers can be readily distinguished. In dealing with the Australian species I

placed them in four sub-families, based on the wing structure, placing the *Calotermitinæ* as the first division.

Desneux, in his paper, "Apropos de la Phylogenic des Termitides," published in the "Annals of the Societé Entomologique de Belgique," last year (1904), makes some critical remarks upon my classification, in which he places the sub-family *Termitinæ* first, with the *Rhinotermitinæ* as a group with them, and the *Hodoterminæ* as a group of the *Calotermitinæ*, forming a third sub-family, *Mastotermitinæ* to contain my genus *Mastotermes*. If, however, we take the robust termites as those most closely allied to the cockroaches, we must commence with *Mastotermes*, following up with *Calotermes*, with the more feeble-winged *Termitinæ* connecting them with the *Embiidæ*.

Wasmann has created a new sub-genus (*Coptotermes truncatus*) for a termite in Madagascar, which has the front of the head furnished with an opening above the jaws, from which it can discharge a protective fluid when molested; this appears to be a valid distinction worthy of generic rank, and will include two of my species, and a third Wasmann has since described from West Australia.

In adopting Desneaux's new sub-family for my thick-winged termite from Port Darwin, and thus taking it out of the *Calotermitinæ*, I still retain my two other sub-families, and the *Rhinotermes*, while coming after the *Calotermes*, are very easily seperated by their wing structure.

The following is the order in which I would place them:—

ORDER—ORTHOPTERA.

FAMILY—TERMITIDÆ.

SUB-FAMILY I.—MASTOTERMITINÆ.	*Genus* I.—*Mastotermes*.
II.—CALOTERMITINÆ.	I.—*Calotermes*.
"	II.—*Stolotermes*.
III.—RHINOTERMITINÆ.	I.—*Rhinotermes*.
IV.—GLYPTOTERMITINÆ.	I.—*Glyptotermes*.
V.—HETEROTERMITINÆ.	I.—*Heterotermes*.
VI.—TERMITINÆ.	I.—*Termes*.
,,	II.—*Coptotermes*.
,,	III.—*Eutermes*.

SUB-FAMILY I.—MASTOTERMITINÆ.

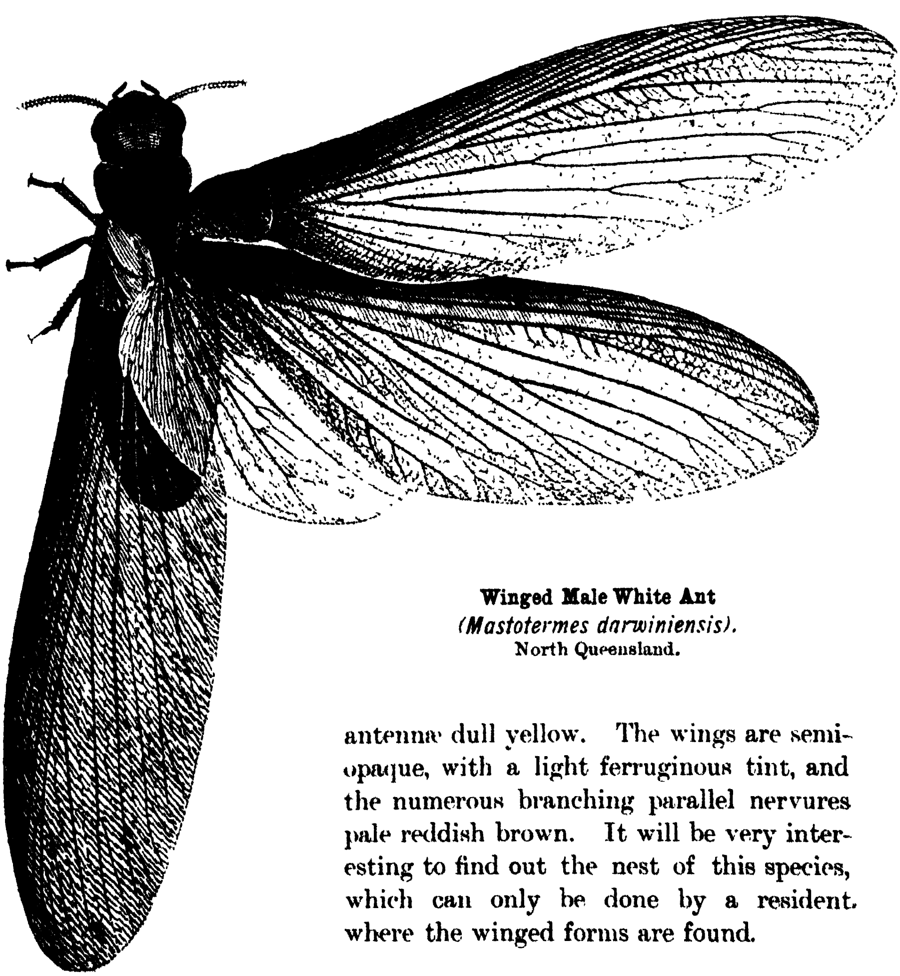
Genus I.—*Mastotermes*, Froggatt.

The head large, nearly as long as broad, flattened on the summit; eyes large, projecting; ocelli prominent, with antennæ composed of

thirty or more segments; prothorax saddle-shaped, outer margins turned up, with the scapular shield as long as meso and meta thorax combined; the fore wings different from the hind ones in possessing fewer parallel nervures between the costal and sub-costal veins, the upper portion or fore margins of both pair crossed with stout nervures, and the whole of the wings finely reticulated.

The Thick-winged Termite (*Mastotermes darwiniensis*, Froggatt).

This is a rather common species of white ant in North Queensland, Port Darwin, and Kimberley, N. West Australia, where in the summer time they are often found flying round the lamps at night, but nothing is known about their habits, nests, or the workers or soldiers. It is our largest known species, measuring 1⅓ inches in length to the tip of the folded wings, with the body about ¾ of an inch in length. Its general colour is chestnut brown, with the head of a more rusty red tint, and the



Winged Male White Ant
(Mastotermes darwiniensis).
North Queensland.

antennæ dull yellow. The wings are semi-opaque, with a light ferruginous tint, and the numerous branching parallel nervures pale reddish brown. It will be very interesting to find out the nest of this species, which can only be done by a resident where the winged forms are found.

SUB-FAMILY II.—CALOTERMITINÆ.

The members of this group have robust wings, reddish brown in the typical *Calotermes*, with the front parallel nervures connected by a number of cross nervures, or veinlets forming a network of irregular cells. The scapular shield has five or more nervures branching from the base, and in some genera the neurations of the fore and hind pair of wings differ.

A number of fossil forms have been described, for which new genera have been created, and other recent species found in the Old World and America are not represented in Australia. The genus *Stolotermes* is included here, for though not found on the mainland, one species has been described from Tasmania, and two from New Zealand.

Genus 1.—*Calotermes*, Hagen.

These termites do not construct regular nests, but live in small communities in tree trunks or fallen logs, often not more than a hundred in a colony, which consist chiefly of immature winged forms and workers; the soldiers in some species are often very scarce, and form a very small unit in the nest. The perfect insects are usually of a light reddish brown, and are easily recognised by the more complicated venation of the wings. The soldiers have large heads, dark reddish brown, the jaws black; the latter are thickened, stout and blunt, turned in at the tips, and the jaws are irregularly toothed on the inner edge on the opposite sides. Seven species are described from Australia, and one from New Zealand; others are found in various parts of the world.

SYNOPSIS OF SPECIES, winged forms, and soldiers.

1. *Calotermes convexus*, Walker. Ferruginous, wings pale brown. Antennæ, 13-jointed: wings with 12 oblique nervures.
2. *Calotermes insularis*, White. Bright ferruginous, wings hyaline, very long; with 9 oblique nervures.
3. *Calotermes irregularis*, Froggatt. Ochreous, wings pale ochreous, with 13 oblique nervures. Antennæ, 19-jointed.
4. *Calotermes improbus*, Hagen. Chestnut brown, head darkest, wings wanting. Antennæ, 20-jointed.
5. *Calotermes longiceps*, Froggatt. Winged form immature. Soldier with head and jaws longer than thorax and abdomen.
6. *Calotermes robustus*, Froggatt. Dark ochreous wings, semi-opaque. Antennæ, 19-jointed.
7. *Calotermes brouni*, Froggatt. Dark reddish brown, wings fuscus, with 13 oblique nervures. Antennæ, 14-jointed.
8. *Calotermes adamsoni*, Froggatt. Ferruginous on head, rest more ochreous, wings pale fuscus, with 9 oblique nervures. Antennæ. 16-jointed.

Broun's Calotermes (*Calotermes brouni*, Froggatt).

This is a very distinct species sent to me by Captain Broun of New Zealand, under the idea that it was *Termes australis*. He says that "This species originally inhabited the Puriri (*Vitex littoralis*) in the northern forests, where the nests consisted of small families. It has been found in buildings as far south as Tauranga, and is widely distributed throughout the Auckland district, even where the Puriri does not grow. This he considers is to be accounted for by the practice of using blocks of this wood for foundations of houses when containing colonies of these calotermes, which afterwards eat their way upwards into the Kauri flooring, and sometimes make their way up the wall studs to the roof, when in the softer Kauri timber, they are more destructive. It is a small dark-winged white ant, under ½ an inch in length, with the body about ¼ of an inch in length. The soldier with a dull dark yellow head, twice the length of its breadth, with broad stout jaws, slender at the tips, with the right hand one furnished with three stout teeth, and the left hand one with only one in the centre.

The Fine-winged Calotermes (*Calotermes robustus*, Froggatt).

This was described from a single, very perfect specimen taken at Sans Souci, near Sydney, flying round the lighted lamp in a house. It resembles *C. insularis* in size and colour, but differs in having the head convex and not flattened in front, a smaller prothorax and the fine reticulation of the wings, which are very different to any other species examined by me. It is a dark dull yellow-coloured insect with semi-opaque wings, and measures ¾ of an inch to the tip of the wings, and nearly ½ an inch to the tip of the abdomen, and 19-jointed antennæ.

The Common Calotermes (*Calotermes longiceps*, Froggatt).

This is our common species, often met with in small communities of from twenty to one hundred, generally composed of immature winged forms, workers, and only two or three soldiers. I have never been able to obtain the perfect winged forms, though they lived in captivity for months. They form irregular cavities and narrow galleries in the hard eucalyptus logs.

The immature winged forms measure ½ an inch in length, and, like the worker, are stout and cylindrical in form. The soldier measures slightly over ½ an inch in length, with the head and jaws combined as long as thorax and abdomen. The head is very large, longer than broad, bright reddish brown; black jaws, having three small, irregular teeth on the left-hand side, and one large angular one on the opposite side; the antennæ very slender, composed of twenty joints.

Hagen's Calotermes (*Calotermes improbus*, Hagen).

The winged form is of a general chestnut-brown colour, with the head somewhat darker, and was described by Hagen from a specimen without wings collected in Tasmania, slightly over ½ an inch in length. The identity of this species will always be doubtful.

Walker's Calotermes (*Calotermes convexus*, Walker).

This species was described from a specimen taken in Tasmania. Hagen, in examining the type, says, in his monograph, where he redescribes it, "that the somewhat larger *Termes obscurus* from Swan River, West Australia, is not otherwise different from this one. Between the claws is seen a plantula. This species resembles *Calotermes improbus*, and whether it should remain separate is a matter for further consideration, though it is much smaller. The workers and soldiers, described by Walker as belonging to *Termes australis* are probably those of *Calotermes improbus*. He gives the length of the body as 1½ lines, head longer than broad, ocelli close to the eyes, antennæ shorter than head, probably 13-jointed. Soldier 3 lines in length, with reddish-yellow oval head, flattened, and ferruginous in front; jaws dark, almost straight, with two broad teeth. I have not been able to identify this termite in my collections.

Long-headed Calotermes (*Calotermes irregularis*, Froggatt).

The winged form ⅜ of an inch to the tip of the pale ochreous wings, and about ⅓ of an inch to the tip of the body. The head is rusty red, the thorax and abdomen dark dull yellow, with the under surface lighter coloured.

The soldier has a reddish head, with black jaws, longer than broad, and pale dull yellow thorax, and is about ½ an inch in length, with head and jaws taking up nearly half of it; antennæ 19-jointed, with the jaws stout and thick, with several small teeth along the left-hand jaw, and two long angular ones on the right side. This species was obtained by Turner in small colonies in the Mackay district, Queensland

The Long-winged Calotermes (*Calotermes insularis*, White).

This species was described by White from winged forms taken in New Zealand, but Bauer records it from New Holland. I received a dried pinned specimen from the National Museum taken near Melbourne, Victoria, which has the typical long wings of this species, and agrees in other details The body measures under ⅓ an inch in length, and nearly an inch to the tip of the wings. The head is longer than broad, with large eyes and ocelli. Antennæ broken. The prothorax very large, broader than long. Wings four times the length of the breadth and rather sharp at the extremities

Adamson's Calotermes (*Calotermes adamsoni*, Froggatt).

This white ant is common in the Uralla district, where they are found in small families in dead logs and stumps, forming irregular galleries.

The winged form has the head ferruginous; thorax dull yellow; wings pale fuscus; it measures nearly ⅜ of an inch in length to the tip of the wings, and ¼ of an inch to the tip of the body. The wings are long and slender, rounded at the tips. The soldier has a bright reddish brown head, a little longer than broad and flattened on the summit; jaws short and stout, with three sharp incised teeth on the upper portion and one large one below on the left hand, and only one curved fang near the tip, and a broad angular tooth below on the opposite side. The winged form differs from the other members of the genus in having no ocelli, but as the wings are so typical it should, I think, be included in the genus.

Genus II.—*Stolotermes*, Hagen.

These termites are allied to the members of the American genus *Hodotermes*, but differs in having few joints in the antennæ; ocelli present in the winged insects, and a heart-shaped prothorax: the tarsi with the first joint as long as the succeeding ones. The wings are small with the straight medium nervure like those of the *Eutermes*. They live in small communities like the *Calotermes*, and though no species have been found on the mainland, one has been described by Hagen from Tasmania, and another by Brauer from New Zealand; and it is apparently not uncommon in some districts.

Stolotermes bruneicornis, Brauer.

It is a dark brown species with fuscus wings, measuring slightly over ⅜ an inch in length, and about ¼ to the tip of the body. Antennæ, 16-jointed. Hagen described it from three specimens in the Berlin Muesum. I have never been able to find it in Tasmania.

Stolotermes ruficeps, Brauer.

This species was collected during the voyage of the "Novara" at New Zealand, and is apparently not uncommon, as I have had specimens sent from Drury several times. It is slightly smaller than the former species, of a more reddish-brown colour, with a spherical head and fifteen joints on the antennæ. The soldier has a bright yellow head, longer than broad, stout curved jaws, with two blunt teeth in the centre, and a pair of distinct facetted eyes.

SUB-FAMILY III.—RHINOTERMITINÆ.

This division contains the single genus *Rhinotermes*, which Hagen used as a sub-genus, placing in it three species from the West Indies and Brazil, and a fourth from Australia, which he distinguished chiefly by the structure of the front part of the head, which is cleft, and the venation of the wings.

Genus I.—*Rhinotermes*, Hagen.

These termites have the scapular shield broad and convex at the cross suture; the main parallel veins stout and connected with the nervures like that of *Calotermes*, and the whole wing covered with fine wrinkles or ridges. The head is broad, furnished with small eyes and ocelli, and 20-jointed antennæ; the front of the thorax not as wide as the head. Two species are recorded from Australia. (1) *Rhinotermes intermedius*, Brauer. Pale ochreous, wings pale ferruginous; eyes and ocelli large in proportion. (2) *Rhinotermes reticulatus*, Froggatt. Pale ferruginous, wings reddish brown, eyes and ocelli small.

Rhinotermes intermedius, Brauer.

This termite forms small colonies all along the eastern coast, generally in stumps covered with their dead bark, under which they tunnel, but are occasionally found under dead logs. The winged form has the upper surface pale ochreous, with pale ferruginous semi-transparent wings, measuring over ½ an inch to the tip of the wings, and about ⅓ to the tip of the body. They are easily distinguished by the reticulated delicately crenulated wings and curious cleft forehead.

The soldiers are timid creatures, rushing off to hide as soon as they are disturbed, and consist of two very distinct varieties. The large one about ¼ of an inch in length, with large yellow broad head, furnished with long spade-shaped labrum and short curved jaws with two sharp teeth on the left side and one on the right. The minor soldier is fully a third smaller, with the head small and pear shaped; the jaws long and slender-toothed in the same manner, and curving over at the tips; very long palps, and 16-jointed antennæ.

Rhinotermes reticularis, Froggatt.

This species is the common one at Kalgoorlie, West Australia, and takes the place of the eastern form; it is smaller, with a more ferruginous tint, the wings lighter coloured with tawny nervures. It has the same peculiar structure of the head and two distinct kinds of soldiers.

They were found in a dead sheoak stump at Kalgoorlie by my father in March, when the winged forms were emerging. Others were obtained at Palm Creek, Central Australia, by the Horn Expedition.

SUB-FAMILY IV.—GLYPTOTERMITINÆ.

This division contains a single genus formed by me for the reception of the three species of small dark-coloured termites living in small communites in the trunks of trees, the soldier and workers of which are elongated and cylindrical in form.

Genus I.—*Glyptotermes*, Froggatt.

The head is broad, with moderately large eyes, with the ocelli almost touching them; antennæ 13-15-jointed, springing from a circular cleft.

in front of the eyes. The prothorax rounded on either side; long slender dark-coloured wings, with the three parallel nervures running close to each other, the second often merging into the front (costal) one in the middle, but always free at the extremity, and the oblique nervures are often composed of rows of dots.

1. *Glyptotermes eucalypti.* Soldier, antennæ 14-jointed, three sharp angular teeth on each side. Head long, truncate in front.
2. *Glyptotermes tuberculatis.* Soldier, antennæ 15-jointed, a stout spine standing out in front on sides of head; two teeth on left-hand jaw and one on right.
3. *Glyptotermes brevicornis.* Soldier, antennæ 13-jointed. Very rugose on front of head; three teeth in left and two in right-hand jaw.
4. *Glyptotermes iridipennis.* Winged form (only known), antennæ 15-jointed; wings very long and slender.

Glyptotermes eucalypti, Froggatt.

This is the common species of the genus about Sydney, and is only found by cutting off the outer rough bark of the Swamp Mahogany (*Eucalyptus robusta*). The termites, working through from the decaying centre of the trunk, burrow through the living sap-wood and inner bark, into which they gnaw narrow circular passages in all directions, so constricted that one cannot pass the other and they must work independently. They live in small communities, the bulk of which are workers or larval forms, perhaps fifty in a colony, with very often only two or three soldiers among them. The workers and soldiers are slender and cylindrical in form, only differing outwardly in the shape and structure of the head, which in the soldier is pale reddish yellow, with 14-jointed antennæ; stout short jaws turning over at the tips with three sharp angular teeth on either side; in the worker the head is spherical and of a pale yellow tint.

The winged termite is chestnut brown, with semi-opaque slender wings four times as long as broad. It measures to the tip of the wings under $\frac{1}{3}$ of an inch, and slightly over $\frac{1}{6}$ to the apex of the body; it is much smaller in proportion to the workers and soldiers than any of the other species. The eyes are large, ocelli oval, the antennæ 14-jointed, the prothorax nearly as broad as the head, broader than long, and slightly concave in front.

Glyptotermes tuberculatus, Froggatt.

This species comes from Uralla, New South Wales, where they were cut out of a log; I have not seen it from anywhere else. The winged termite is of a general pale dull yellow colour, with transparent wings, and dark nervures. It measures $\frac{1}{2}$ an inch in length to the tip of the wings, and just under $\frac{1}{4}$ to the tip of the body. The soldier has the head bright reddish brown, black jaws, prothorax ochreous, and the rest dull yellow. It measures $\frac{1}{4}$ of an inch, of a slender cylindrical form. The worker of very similar shape except that the head is spherical. The jaws of the

soldier are short, with two stout angular teeth below the tip on the left side, with one large one at the base on the left side. A stout cylindrical spine stands out on either side of the front of the head.

Glyptotermes brevicornis, Froggatt.

This is a species collected by Turner in the Mackay district, Queensland, of a similar colour, but smaller than *G. tuberculatus;* having small eyes not standing out on the sides of the head, and 13-jointed antennæ. The wings short, slender, and about twice as long as broad.

The soldier has a head twice as long as broad, rounded behind, but straight upon the sides; pale rusty red at base, but much darker in front, which is very rugose above the jaws; the latter short with three small angular teeth on the left jaw, and two larger ones on the right. Length under ⅓ of an inch, body elongate and cylindrical. The smaller worker has the rounded head and prothorax pale yellow, with the body like that of the soldier, only more hairy.

Glyptotermes iridipennis, Froggatt.

This is a dark brown termite, with clouded light reddish brown wings. It measures ½ an inch to the tip of the wings, and ¼ to the apex of abdomen. The head is longer than broad, convex, and sloping down in front; small eyes; 15-jointed antennæ. The wings are very long, four times that of the breadth, slender, and slightly pointed at the tips. The type, which was mounted on card, comes from Frankston, Victoria; I have not seen any other specimens.

SUB-FAMILY V.—HETEROTERMITINÆ.

Differing from the last division in having the head longer than broad, and the absence of ocelli. The costal and sub-costal nervures not in contact. It contains a single genus, created for the reception of a very distinct form from Kangaroo Island, South Australia.

Genus I.—*Heterotermes*, Froggatt.

Besides the definitions in the sub-family, the head is nearly quadrate, the eyes very small and not projecting; antennæ 16-jointed. Wings nearly thrice as long as broad, with the scapular shield small and angular.

Heterotermes platycephalus, Froggatt.

The type was received from Adelaide, and collected on Kangaroo Island some years before. It is a very curious termite differing from all known species in the almost square head and thick antennæ. In the Macleay Museum there are four other specimens labelled South Australia.

The general colour is dark chestnut brown; the antennæ barred with lighter bands at the base of each segment; the wings of a pale smoky tint. It measures ½ an inch to the tip of the wings, and under ¼ to the apex of abdomen.

(To be continued.)

Farmers' Fowls.

[Continued from page 422.]

G. BRADSHAW.

Chapter VI.

WYANDOTTES.

Introduction to Australia.

In fancy poultry, of whatever sort or origination, once they become plentiful in England and classes provided for them in the shows, Australian fanciers soon follow suit. In this breed however, they were rather slow, for although specimens reached England between 1868 and 1870, the first of them did not appear here until the tenth annual exhibition of the New South Wales P.P. and D. Society, in 1887. There was but one class made for the breed, and like other fancy poultry then, were shown in pairs. Four entries of them appeared at the show, contributed by Messrs. John Dilling, of Marrickville, C. Irvin, of Burwood, and W. Hope, of Liverpool.

When once introduced, the fanciers took to it as enthusiastically as in other countries. The annual increasing entries at the shows, and the origination of new varieties or colours, warranting additional classification almost every year. The one class with the four entries which appeared the year of their introduction had in a decade increased to ten classes, represented with 150 entries, while the present year's catalogue of the Royal Agricultural Society's Easter Show contains sixteen classes, with an entry of 170.

As already stated, Silver Wyandottes were a good many years established in England before they reached Australia. Not so with the Golds, they having been shown only two years there before they appeared in Sydney, and their introduction here is to be credited to Mr. Hugh Dunlop, of Balmain, who, realising the growing popularity of the Silvers, rightly predicted success for the Golds, and, setting aside the usual methods of importing American breeds from England, went to the fountain head for his stock. The birds were purchased from Messrs. Perrine & Co., large breeders in Alameda, California. The pair cost 30 dollars in America, and nearly as much more in freight and other charges to Sydney, arriving here in August, 1890. The birds were of good type and colour, and equal to any seen for several years afterwards, but a good deal foreign in colour from those which have been arriving from England within the past few years. Shortly after this a pair of hens arrived on the ship "Illawarra," from London. These were purchased by the writer, and afterwards went to the yards of the late T. Hall, of Fairfield. The next importer was Mr. R. Colman, of Bathurst. All the above forming the Gold Wyandotte stock of the State for a number of years.

Since 1898, numerous consignments of this colour have arrived each year from England; a few have also been imported from America, but the latter have been unsatisfactory in both colour and type, and rarely caught the judge's eye when exhibited. In a few years the Golds had overtaken the Silvers in the numbers shown, but of late the latter have again taken the lead. Perhaps the best, if not the most numerous, display witnessed being at the Royal Agricultural Society's 1902 Show, when nine cocks, twelve hens, twenty-one cockerels, and thirty-two pullets were on view. Big displays of the Silvers have also appeared at the fanciers' shows, all tending to the belief that of the laced varieties the Silvers will continue their leading position.

The White variety for a few years did not make much headway, but the last two or three years they appeared to be more plentiful, and exhibited in greater numbers than any of the other colours. There were fifty-two entries of them at the late Royal Show, the next highest being Silvers with forty-three. This is also taking place in America, as is shown earlier in this article, where Whites, at the St. Louis Exhibition, were in numbers several hundreds ahead of any other breed or variety at the exposition. In England also, at the present time, they are more plentifully bred and shown than any of the other varieties.

Buffs were introduced to Sydney eight or nine years ago, and as this colour was then becoming a fashionable one in fowls, it was thought there would be a boom in Buff Wyandottes. Such, however, did not come off. Those wanting a Buff fowl went for that colour in Orpingtons, and up to the present time, although a few good Buff Wyandottes are about, neither the fancier nor the utility breeder appear to want them.

The first Partridge Wyandottes to reach Sydney were brought out by the late Mr. W. Cook, on his visit to Australia about four years ago. For a year or two fanciers were rather shy of the variety; however, the later importations, showing better type and colour, has done much to increase interest in this variety. Perhaps the best to arrive being those which came to the order of Mr. C. H. Bayley during the past year, while consignments for other fanciers by the "Moravian," early in March last, include some of the best that have been bred in England, and should do much to further increase the interest in this variety, which, as the illustration in the *Gazette* shows, is about the handsomest of the whole Wyandotte family.

The Silver-pencilled variety is expected to be exhibited for the first time during the present season. The illustration of the cock of this variety will give an excellent idea of what an exhibition bird should be.

CHAPTER VII.

Wyandottes for the Table.

Farmers' Fowls being the title to these articles, I now come to the merits of Wyandottes which warrant such an appellation. So far as

my own experience goes, I had the honour of placing the first pair of this breed in a Sydney show pen, now nearly eighteen years ago, and have in various ways been connected with, and a patient observer of them until the present day, and, although I do not say that Wyandottes are the best of all, and the only breed, I do maintain they have every essential factor which goes to constitute them a most profitable breed to keep by those for whom these articles are intended, and highly deserving of the highest position amongst the several breeds embodied in the comprehensive nomenclature of farmers' fowls.

One important feature of the breed is the fact that being rather short-legged and cobby in build, with, consequently, finer bones and smaller carcase than the Langshan, Rock, or Orpington, when the

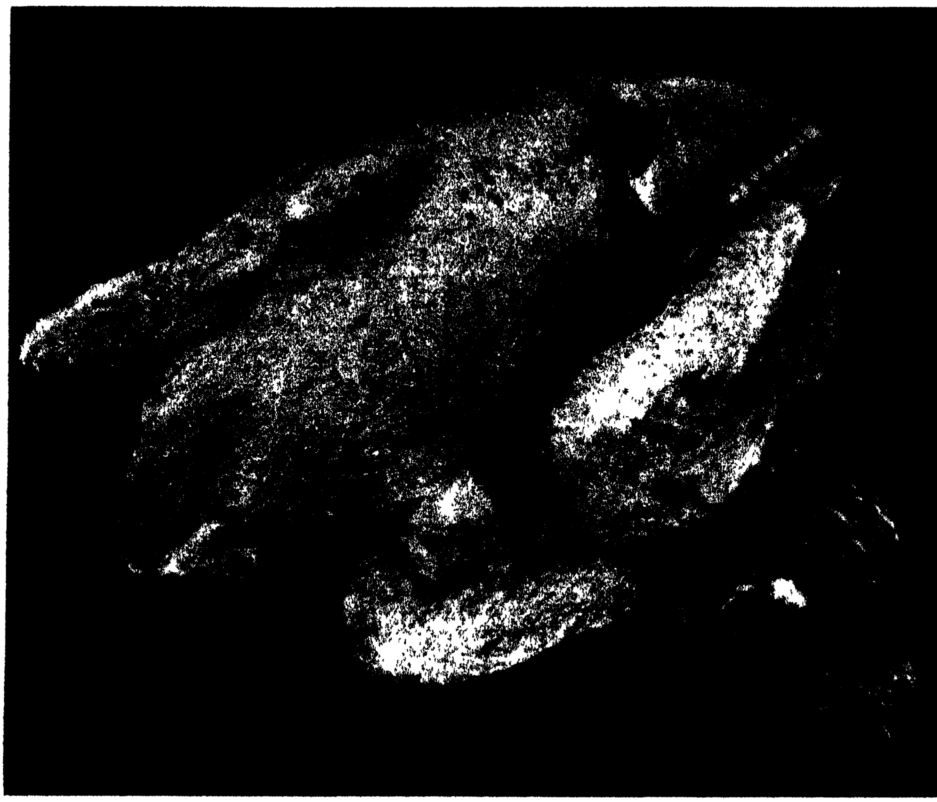
Wyandotte Cockerel.

Hatched, 14th December, 1904; killed, 18th April, 1905; live weight, 4lb 14 oz.

latter three breeds, but particularly the first two, are growing a framework of bones, on which, later on, to place a big carcase of meat, the Wyandotte is growing flesh and bones at the same time; and if chickens of all the four breeds are in the same flock, it will be found that if caught at any time during the second, third, and fourth month, the Wyandottes will be plumper and fleshier than the other breeds, and always in killing condition within the above period, and, if well fed from hatching to killing time, will require no special fattening for either the local or other markets. After four or five months the other breeds will overtake and pass them in weight; but poultrymen being, like other producers, anxious to realise as quickly as possible,

find it safer to accept 4s. or 5s. a couple for four or five months' old chickens, than to hold over a month or two longer in the mere hope of higher figures.

In my articles on this breed in 1898, I gave comparisons as to the growth made that year with Wyandotte chickens and others of the then favourite Langshan. Since then, I have experimented with several other breeds, and, so far, have had no results better than the Wyandottes, except from a breed with which I am at present experimenting, the results of which will not be available in time for this article.



Wyandotte Pullet.

Hatched, 11th January, 1905; killed, 18th April, 1905; live weight, 3 lb. 6 oz.

The following comparison of Wyandotte and Langshans appeared in the *Gazette* in October, 1898. The experiments made with Dorkings and Orpingtons were made two years later, but all were fed and kept approximately alike :—

		Wyandottes.	Langshans.	Orpingtons.	Dorkings.
	Weeks	Ounces.	Ounces.	Ounces	Ounces.
Age ...	4	8	8	8½	7½
,,	6	15	15	16	14
,,	8	24	22	25	21
,,	10	32	28	29	28
..	12	40	38	38	37
,,	14	52	50	48	44
,,	16	64	64	65	60
,,	18	72	74	75	68

The chickens were carefully weighed each week, but only fortnightly results are given. It will be seen that up to fourteen weeks the Wyandottes made the most weight, the Langshans and Orpingtons then overtaking them, the three breeds scaling 4 lb. for each chicken at sixteen weeks. The Dorkings were a puny lot, and never did well, some of them dying during the course of the experiment, other specimens of the same flock having to be substituted. It should be noted that, although all three breeds give about equal results for the food and attendance, such equality was more apparent than real, for while the sixteen weeks old Wyandottes were plump, fleshy chickens, with good breast, and quite fit to kill, the other breeds being bigger framed and bodied birds were, to this time, but making bone, muscle, and frame to carry the big quantities of meat expected thereon at six or eight months of age.

The accompanying illustration of two chickens of this breed (cockerel and pullet) further emphasises the contentions that whatever the merits of other breeds or varieties of fowls may be, the Wyandotte is one that cannot be overlooked where fast-growing plump carcases are wanted, this feature alone constituting them a farmer's fowl.

The cockerel was hatched on the 14th December and the pullet on 11th January, and both killed on 18th April, and photographed by Mr. Grosse, artist to the Department of Agriculture, on the same day. The weights are better than those tabulated above, the cockerel weighing 4 lb. 14 oz. at eighteen weeks, and the pullet 3 lb. 6 oz. at fourteen weeks, live weight.

With this and the previous records as to meat capabilities of fowls, those desiring such essentials need have no hesitancy in adopting any variety of the now favourite and plentiful Wyandotte.

Chapter VIII.

Wyandottes for Eggs.

It has been already shown that owing to the comparative scarcity of this breed of fowls in New South Wales eight or more years ago, there was much difficulty in securing reliable testimony as to the merits of the breed, for although my experience with them was most satisfactory, I was too well acquainted with the erratic nature of the domestic hen to accept my own experiences as conclusive evidence of the characteristics of the then Wyandotte; and I may be here permitted to remark that the man or woman who finds the breed of fowls which he or she keeps satisfactory, there should be much caution before changing for an expected better one; and if a patron of some breed or variety finds such unprofitable, and a determination made to try another, then when electing this new one, a good character of it should be obtained from more than one source, seeing that in egg-production, strains or families play an important part; some Wyandottes being just as bad performers as are to be found in a flock of common fowls, and on this subject of strain the English Utility

Poultry Club have at each of eight laying competitions attached the following note to its reports:—"The competitions are not given to determine which is the best breed, the club recognising that good laying is a question of strain and not of breed."

Realising all this, and in order to secure an opinion from the patrons of Wyandottes as to the merits of this breed as then known, I communicated with the most prominent of them in this State in the following terms:—

(1.) What length of time have you kept this breed?

(2.) Are the chickens easier or more difficult to rear than other breeds?

(3.) At what age do the pullets begin to lay?

(4.) Do they grow as fast and develop as quickly as other breeds?

(5.) What is your opinion of them as farmers' fowls?

(6.) What is your experience of them as layers?

One breeder wrote:—"Having a very limited space in which to keep fowls, I tried nearly all the popular breeds, and can safely say I was never so well suited as I am by Gold Wyandottes for good utility fowls; having such remarkably small wings they do not attempt to fly, are quiet and contented in a small space, and are not large eaters. They lay quite as well as any of the best-laying breeds, while as table fowls they are second to none, a combination hard to produce, and as sitters and mothers are excellent."

The proprietor of a long-established poultry farm wrote as follows:—"I have kept Silvers and Golds about eight years, and Whites two years. I find they grow and develop quickly. I have had cockerels weighing 5½ lb. at five months old. My winning Golden cockerel at the last show was eight months old and weighed 8 lb. The chickens are easy to rear. I have more successful hatchings of Rocks and Wyandottes than any other variety. In mixed sittings of Rock and Wyandottes I see no appreciable difference in growth and development of chickens; the pullets occasionally lay at five and six months old. I am not in favour of forcing pullets to lay too soon, and try to keep them back. I believe that laying before seven months affects or stops the growth of the hen. My experience is that early laying pullets make the poorest layers as hens; all the Wyandottes are good winter layers; you can rely on them for eggs when prices are high. They make a good cross, but no cross that I ever kept can equal the pure Wyandotte, either for weight or quality of flesh. They are good sitters and mothers, and are easily broken off being broody. The demand for stock birds and settings of eggs is steadily increasing in all varieties—all are so good, I cannot say which I prefer."

Another firm of breeders and exhibitors contributed the following:—"We took up Wyandottes—Silver-laced—about seven or eight years ago, and soon after the Gold variety. Since then we have added the Whites to our stock. We find the chickens very hardy, and more easily reared than other breeds; they grow fast and develop very quickly into fine blocky birds. We have had them lay between four and five months old, and as layers they compare favourably with

either Leghorns or Minorcas, and as winter layers they beat either of those two varieties; while as farmers' fowls we find them as near perfection as it is possible to get any breed, for the reason that they are good layers, good birds for the table, good sitters and brooders, very quiet and docile, while a 4-foot fence will confine them."

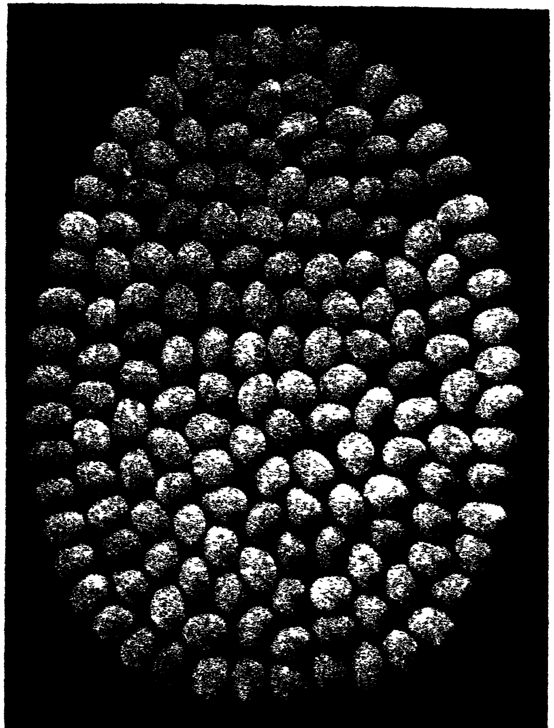
Another breeder's contribution was:—"I have kept the Wyandottes since shortly after their arrival in the colony. I have found the chickens very hardy and easy to rear, and grow quicker than any other variety. The pullets commence to lay at about five months. I find them first-class layers, and as farmers' and general purpose fowls, none can surpass them."

A further contribution reads:—"I have kept the Wyandottes for about five years, and have found the chickens quite as easy to rear as any of the other breeds. Some begin to lay at five months, others not until seven or eight months. The chickens grow quickly, but feather a bit slowly in cold weather. As farmers' fowls, I consider them next best to the Orpington; the latter I consider the king of utility fowls, especially the Buffs. The Wyandottes are first rate layers all the year round; I could not wish for better. The sale of stock-birds and eggs is not so good as that of other breeds I keep, but the public are beginning to find out what a grand fowl it is, and I predict a great market for it at an early date."

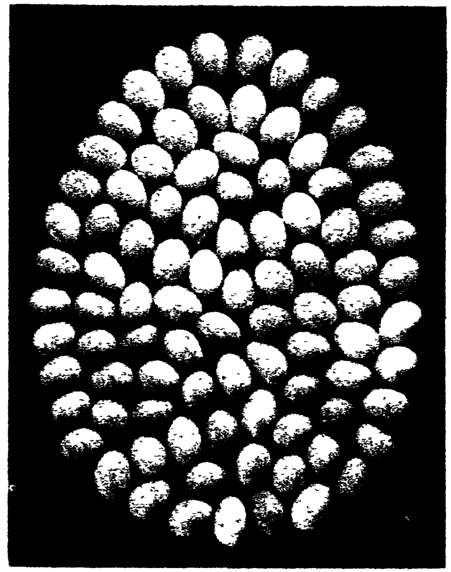
A large poultry breeder wrote:—"I find the chickens the easiest to rear of any breed I have handled up to the age of twelve weeks. They are the fastest growers of any breed I rear, and are exceedingly plump and well developed. I have had pullets start to lay as early as four and a half months; but they usually commence at five and a half or six months. As layers, they are the best of the sitting breeds, especially as winter layers. I consider them the ideal fowl for farmers, and always recommend them as such, for they lay well when eggs are dear, which also means early sitters, thus enabling the farmers to get early crops of chickens, which can be marketed at a price more than double that of later hatches. They are easily confined, and always ready for market, whether at three months or three years."

The last contribution was from an experienced breeder, who wrote well of the breed as quick growers, &c., but found their performances as layers far from good, the annual average being from 110 to 130 eggs per hen per year.

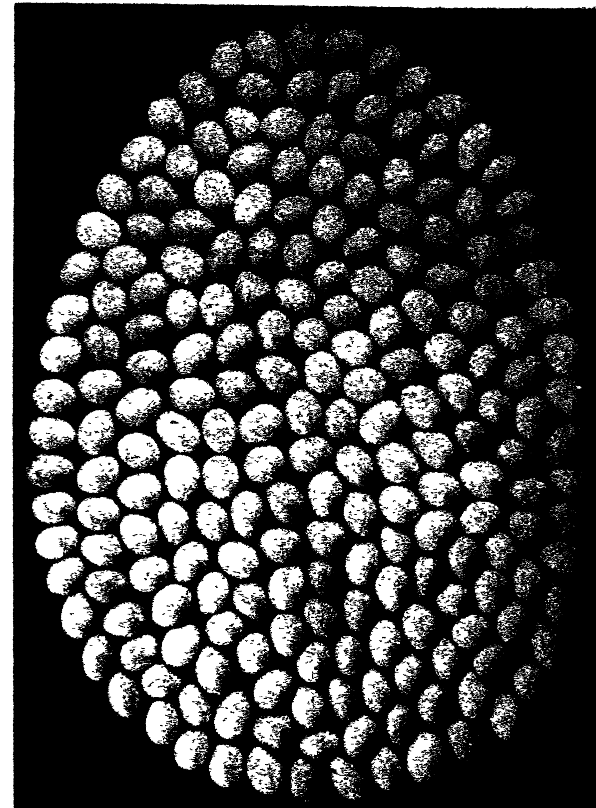
The above opinions were given seven years ago, and despite all the newer breeds and varieties which have since originated, the majority of the contributors continue breeding the Wyandottes, which is conclusive that their lengthened experience has confirmed their earlier convictions that the breed for all practical purposes, as the Americans say, fills the bill. It will be noted that one of the contributors rather discounted the egg-producing merits of the breed, from his experience of them as poor performers at that time, there are a proportionate number of people with the same belief at the present day, and all confirmatory of my frequent contention that breed in fowls is but one thing; strain playing a larger part in the profitableness of poultry keeping when eggs are the principal object.



145 Eggs Average laying of 126 Wyandottes for twelve months



[illegible] Eggs The lowest record made in twelve months.



204 Eggs The highest record made in twelve months

From records of the Third Egg-laying Competition at the Hawkesbury Agricultural College, 1904–5.

It may be here thought, that in order to secure more up-to-date opinions about egg-production than that supplied some years ago, the present patrons of the breed might have been consulted. What, however, was practicable at that time is not so now, owing to the extraordinary increase in the number of breeders, for in every town, suburb, and settled district in the country Wyandottes abound. Still the records have been obtained, and in a more unquestioned manner than any other available way. I refer to the English laying competition, and that conducted at the Hawkesbury Agricultural College.

The English laying tests were incepted by the Utility Poultry Club of that country, and are held only throughout the severe winter months of each year, with the object of encouraging laying when eggs are at their dearest. The first competition was held in 1896, and repeated each winter, and of the eight now held, four of them have been won by Wyandottes; that which concluded on the 22nd of January last was won by Leghorns, a breed not reputed as great winter performers, this fact again bringing into prominence the uncertainty of hens no matter what breed.

In connection with the last English competition, each hen's laying is recorded by the now much adopted trap nest, its advantages being, that rather than the produce of the four birds being averaged at the close of the test, and the bad layers in the pen getting credit for as many as the good layer, the recording nest system admits of no averaging, each hen getting credit for her actual performance

The manager of the English competition points out the importance of this feature, by showing that while the winning pen averaged 61 eggs each hen in the sixteen weeks, the actual laying, individually, was as high as 69, and as low as 49. Again, while the third pen of White Wyandottes had an average of 57 each in the sixteen weeks, the trap nest actually showed that one of the hens in this pen made the record for the competition of 73 eggs, while another one in the same pen only produced 37. Consequently, had the trap nest not been in use, the latter drone would have got credit for 57, viz., 20 eggs more than she actually laid, while the hen that put up the record of 73, by the average system would have been credited with but 57, an actual loss of 16 eggs. However, taking the last competition all in all, of the 36 pens, Wyandottes at the close occupied third, fourth, sixth, eighth, ninth, tenth, and some lower places, and, just like more than one of the tests here, a pen of the same breed came in last: and again—thanks to the recording nest—two hens (both White Wyandottes) did not lay an egg during the course of the competition. In the absence of this valuable invention the two specimens, under the average plan, would have got credit for 34 and 22 eggs respectively.

Coming to the Hawkesbury competition for evidence in favour of the laying properties of Wyandottes, the testimony will be genuinely accepted here. The birds were drawn from all parts of this State, some from Victoria and America, owned by fanciers, poultry-farmers, and other breeders. They were all young birds, under the same control, fed, housed, and otherwise managed alike, and faithful records taken, hence the figures for the twelve months' test will stand

as testimony in favour, or otherwise, of the many breeds which took part therein. The final result was again overwhelming evidence that there are good and bad layers in all breeds, and particularly so in Wyandottes. The winning-pen of six birds of the silver variety finished with 1,224 eggs to their credit, being an average of 204 for each hen, while, to complete the disparity, another pen of the same breed laid but 533, or about 89 for each hen, considerably less than half the number laid by the winners. It may be retorted by some, that although the highest record was made by the silver-laced variety, the pen that did so badly, although Wyandottes, were of a different variety. This contention is quite true. However, there is not much in the admission, seeing that the Silvers were lowest, but one, *i.e.*, occupying 99th place at the final. The illustrations accompanying this article will best show the difference between the good and bad layers. The larger photograph shows the actual number of eggs, 204, laid by each of the hens in the winning-pen, the smallest picture showing 89 eggs, the output of the lowest. It is, however, with the centre figure that poultry-keepers will be most concerned, as it affords the safest basis on which to approximate the egg expectation from an average flock of young Wyandottes during their first year's laying, and should this flock be kept two, three, or four years more, the yield gradually diminishes, few hens during their third year producing more than pays their feed-bill.

Of the one hundred pens competing at the college, thirty-one lots were Wyandottes, representing the different varieties, as follows:—17 Silvers, 6 Whites, 3 Golds, 2 Buffs, 2 Partridges, and 1 Silver-pencilled, totalling 186 birds. The total egg-production for the entire lot for the twelve months averaged 145 eggs for each hen, this being the number represented in the centre illustration. In other words, a flock of young healthy Wyandottes of the several varieties, if well fed and otherwise consistently managed, may be expected to lay twelve dozen eggs each, during the first twelve months of their performance.

The reliability of the Hawkesbury test, for the purpose of this article, has been above briefly referred to. The other varied lessons to be learned from it will, I feel sure, be dealt with by Mr. Thompson, the Poultry Expert, Hawkesbury Agricultural College.

CHAPTER IX.

Judging Wyandottes.

In judging poultry at the various shows in this country, what is known as the English Poultry Club's standard is adopted, as opposed to the American standard, which in every breed is in many essentials much different.

The following extract, which forms a portion of the introduction to the club's standard, will assist in the proper application of the compilation:—"When three or four good judges of any particular variety of fowls assemble before a few good specimens of it, it will generally

be found that they agree in their conclusions as to which is first, second, and third. There are, of course, exceptions; there may be some strong personal interest, and some people have a specially favourite "point," and there are occasional cases of real doubt, when it is very difficult, balancing one point against another, to decide which really is the best in one point, and some other in another, none being alike good in all. As there are many points to be taken account of in every fowl, such a simple fact as this shows that there is some proportion generally accepted, however tacitly and roughly, between the judging value of those points, or of defects in them. For the general opinion, united in as above, does not depend upon the best bird being the best in any one cardinal point; otherwise a class of twenty could be judged in ten minutes. However insensibly and informally it may be done, the aggregate of points or defects have to be weighed, and it is acknowledged by all that excellence or defect in some points is not of so much importance as in others. The standard thus prepared and presented aims first at correctly describing the varieties treated of in languago as simple and comprehensive as possible. In the second place it desires to lay down the fair proportionate value which general opinion considers should be given to any defects in the various points. These proportionate values thus arrived at, it is hoped that qualified judges will recognise and respect, not violently upsetting them by notions of their own; though it is not likely, nor perhaps desirable, that birds should be systematically "scored" by them and prizes awarded accordingly. This has been done in America for years; but it is becoming more doubtful if the system will continue, the larger shows being now judged otherwise. The proper use of a standard is not to give birds a score, but to place them in correct order of merit. It must never be forgotten that small deductions or cuts for conspicuous defects cannot do this. The figures in the "points" following are meant to express what ought to be deducted from the standard 100 points, for as much fault in the points named as can exist, and still leave the bird in competition. Not as much as possible, by any means: for instance, if the point be comb, and ten are allowed, a comb bad beyond a certain degree would throw a bird entirely out, and not be deducted at all. It is meant that if the comb is really about as bad as still leaves the bird any chance at all, the ten should be deducted; and less for slighter defects, perhaps even only one or half a point for very slight defects. But for serious and evident faults *serious cuts must be made* if the standard is to perform its function. Though not employed in systematic judging, it is suggested that in cases of doubt—which sometimes arise, and are then too often decided haphazard, or by some preference—the standard might be applied.

Wyandotte Standard.

General characteristics of cock :—

Head and neck.—Head: Short and broad.

Comb.—Rose, firm and even on head; full of fine work; low and square at front, tapering towards the spike, which should follow the curve of the neck.

Face.—Smooth and fine in texture.

Ear-lobes and wattles.—Medium length, fine in texture.
Neck.—Medium length, well arched, with full hackle.
Body.—*Breast*: Full and round, keel bone straight.
Back.—Broad and short.
Saddle.—Full and broad, rising with concave sweep to tail.
Wings.—Medium size, nicely folded to the side.
Tail.—Well developed, spread at base; the true tail feathers carried rather upright; sickles of medium length.
Legs and feet.—*Thighs*: Of medium length, well covered with soft and webless feathers.
Fluff.—Full and abundant.
Shanks.—Medium length, strong, but fine in bone.
Toes.—Four in number, straight, and well spread.
General shape and carriage.—Graceful and well balanced, resembling a Brahma.
Size and weight.—Rather large. Matured cockerels, about 6½ lb. for Buff-laced, 7 lb. other colours; adult cocks, about 7½ lb. in Buff-laced, 8½ lb. in other colours.

General characteristics of hen :—

Head and neck.—Head, comb, face, ear-lobes, and wattles, as in the cock, but the appendages smaller.
Neck.—Medium length, with short, full hackle.
Body.—To correspond with that of the cock.
Back.—Short and wide at shoulder.
Tail.—Well spread at base.
Legs and feet.—As in the cock.
General shape and carriage.—To correspond with the cock.
Size and weight.—Pullets, 5½ lb. in Buff-laced, 6 lb. in other colours; adult hens, 6½ lb. in Buff-laced, 7 lb. in other colours.

Colour of Silver Wyandottes :—

In both sexes.—*Beak*: Horn colour, shading into or tipped with yellow.
Eye.—Bright bay.
Comb, face, ear-lobes, and wattles.—Bright red.
Shanks and feet.—Bright yellow.
In the cock.—*Head*: Silvery white.
Neck.—Silvery white, with clear black stripe through centre of each feather; free from ticks.
Saddle.—Hackles to match the neck.
Back.—Silvery white, free from yellow or straw colour.
Shoulder tip.—White, laced with black.
Wing-bow.—Silvery white.
Wing coverts.—Evenly laced, forming (at least) two well-defined bars
Secondaries.—Black on inner and wide white stripe on outer web, the edge laced with black.
Primaries or flights.—Black on inner web, and broadly laced white on outer edge.
Breast and under-parts.—The web white, with well-defined jet black lacing, free from double or white outer lacing, the lacing regular from throat to back of thighs, showing green lustre.
Under colour.—Dark slate.
Tail.—True tail feathers, sickles, and coverts, black, showing green lustre.
Thighs and fluff.—Black or dark slate, powdered with dark grey, with clear lacing round hocks and outer side of thighs.
In the hen.—*Head*: Silvery white.
Neck.—Silvery white, with clear black stripe through centre of each feather, free from ticks.
Breast and back.—Under-colour, dark slate; web, white, with regular, well-defined jet black lacing, free from double or outer lacing, and showing green lustre.
Wings.—Same as back, on the broad portion.
Secondaries and primaries.—As in the cock.
Tail.—Black, showing green lustre; the coverts black, with a white centre to each feather.
Thighs and fluff.—Black or dark slate, powdered with dark grey.
[N.B.—Regularity of lacing and quality of colour in all cases to count above any particular breadth of lacing.]

Colour of Golden Wyandottes :—

In both sexes.—Beak : Horn colour, shading into or tipped with yellow.
Eye.—Bright bay.
Comb, face, ear-lobes, and wattles.—Bright red.
Shanks and feet.—Bright yellow.
In the cock.—Head : Rich golden bay.
Neck hackle.—Rich golden bay, with distinct black stripe down the centre of each feather, free from ticks, black outer edging on black tips.
Saddle hackles.—To match the neck.
Back.—Rich bay, free from black or from deep maroon.
Breast and wings.—Same as Silvers, substituting rich golden bay for white in ground colour.
Thighs and fluff.—Black or dark slate slightly powered with gold, with clear lacing round hocks and outer side of thighs.
[N.B.—Brightness and uniformity of colour to be considered of more value than any particular shade.]
In the hen.—Head : Rich golden bay, with distinct black stripe down the centre of each feather, free from ticks, black outer edging, or black tips.
Breast, back, wings, and tail.—As in Silvers, substituting rich golden bay for white as the ground colour.
Thighs and fluff.—Black or dark slate, slightly powdered with gold.
[N.B.—Brightness and equality of ground colour, and regularity of lacing throughout, to be of first importance.]

Colour of White Wyandottes :—

In both sexes.—Beak : Bright yellow.
Eye.—Bright bay.
Comb, face, ear-lobes, and wattles.—Bright red.
Plumage.—Pure white throughout; straw-colour to be avoided.
Legs and feet.—Bright yellow.

Colour of Buff Wyandottes :—

In both sexes.—Beak : Rich yellow.
Eye.—Bright bay.
Comb, face, ear lobes, and wattles.—Bright red.
Plumage.—Any shade of buff from lemon buff to rich buff, on the one side avoiding washiness, and one the other side a reddish tinge. The colour uniform throughout, allowing for greater lustre on the hackle, saddle, and wing-bow, in the case of the cock only.
Legs and feet.—Bright yellow ; toe-nails white.

Colour of Partridge Wyandottes :—

In both sexes.—Beak : Horn colour, shading into or tipped with yellow.
Eye.—Bright bay.
Comb, face, ear-lobes, and wattles.—Bright red.
Legs and feet.—Bright yellow ; toe-nails horn colour.
In the cock.—Head : Rich orange.
Neck.—Orange or golden red, with paler shade at back, each feather having a glossy black stripe down centre.
Back.—Rich dark red, free from maroon or purple shade.
Saddle.—As in the neck hackle.
Wings.—Rich red, as in back
Wing-bar.—Solid black.
Secondaries.—Rich bay on outer web, and black on inner web and end of feather, the rich bay alone showing when the wing is closed.
Breast.—Black, free from ticks.
Fluff.—Solid black.
Tail (including sickles and tail coverts).—Glossy metallic black.
In the hen.—Head : Rich orange.
Neck.—Golden yellow, striped with black.
Breast, back, and wings.—A light brown ground-colour, free from red or yellow tinge, every feather distinctly and plentifully pencilled with a darker shade. Pencilling uniform throughout, to follow the form of the feather. A brick or yellow ground colour objectionable.
Fluff.—Brown (free from yellow or red), slightly pencilled (the more pencilled the better.
Tail.—True tail feathers black, shading to brown at top, which should be well pencilled.

Colour of Silver-pencilled Wyandottes:—

In the cock.—Head: Silvery white. *Neck hackle*: Silvery white, sharply striped with black in the centre of each feather. *Breast*: Glossy black.

Underpart of body, thighs, and fluff.—Black.

Back and shoulder coverts.—Silvery white, except between the shoulders, where the feathers should be black laced with white.

Saddle.— Silvery white, striped sharply with glossy black.

Wing-bows.—Silvery white.

Tail.—Black.

Legs and feet.—Bright yellow.

In the hen.—Head: Silvery white.

Neck hackle.—Silvery white, striped with black.

Tail.—Black, or black edged with grey, or with pencilling.

Remainder of plumage.—Ground colour any shade of grey, but not too brown, with a pencilling of black or a darker shade of grey than the body colour, very clearly defined, following the outline of each feather, as uniform in character as possible; the pencilling or bands on each feather to be numerous.

Legs and feet.—As in cock.

Value of Points in Wyandottes.

Gold or Silver.—Cock or hen.

Defects.	Deduct up to
Defects in comb ...	8
,, head ...	5
,, ear-lobes and wattles	6
,, neck ..	8
,, breast	14
,, back ...	14
,, tail ..	7
,, wings...	12
,, fluff ..	6
,, legs	6
Want of size and condition ...	14
A perfect bird to count ..	100

Whites.—Cock or hen.

Defects.	Deduct up to
Defects in comb ..	8
,, head ...	6
,, ear-lobes and wattles	8
,, neck ...	10
,, back ...	10
,, body ...	12
,, wings...	10
,, tail ..	8
,, legs	8
Want of size and condition ...	20
A perfect bird to count ...	100

Buffs.—Cock or hen.

Defects.	Deduct up to
Defects in comb ...	8
,, head ...	5
,, ear-lobes and wattles	8
,, neck ...	4
,, breast	5
,, back ...	6
,, wings...	5
,, tail ...	5
,, fluff ...	4
,, colour	30
,, legs ...	6
Want of size and condition ...	14
A perfect bird to count ...	100

Partridge.—The cock.

Defects.	Deduct up to
Defects in comb ...	8
,, head ..	5
,, ear-lobes and wattles	6
,, neck ...	12
,, breast	10
,, back	12
,, wings	10
,, tail ..	7
,, fluff	8
,, legs	8
Want of size and condition	14
A perfect bird to count	100

Partridge.—The hen.

Defects.	Deduct up to
Defects in comb ..	8
,, head ..	5
,, ear-lobes and wattles	6
,, neck	12
,, breast	10
,, back ..	12
,, wings...	10
,, tail	7
,, fluff ...	8
,, legs ...	8
Want of size and condition ..	14
A perfect bird to count	100

Serious defects, for which birds should be passed.—Any feathers on shanks or toes; permanent white or yellow in ear-lobes, covering more than one-third of their surface; combs other than rose, or falling over on one side, or so large as to obstruct the sight; wry tails; deformed beaks; crooked backs; shanks other than yellow in colour (except adult cocks and hens, which may shade to light straw colour); feathers other than white in Whites; white in tail, or any conspicuous spotting or peppering on ground of the feathers in Silvers or Golds.

(*To be continued.*)

Ensilage and Other Farm Topics.

The following letter has been received by a resident of Sydney from Col. A. B. Lawrence, of Warsaw, New York State, dated Monday, 27th March, 1905, a gentleman of 70 years of age, who has been for many years identified with agricultural pursuits. His letter will be read with interest:—

I am glad that your people are interested in the use of ensilage—surprised that they are not up-to-date in that successful economy in stock feeding. The least enterprising of our farmers think they must have a silo or get into debt with their stock feeding. During my five years as President of our County Agricultural Society, I preached silo and ensilage feeding, and for four years as President of our New York State Association of County Agricultural Societies, Headquarters, Albany, New York, which called together delegates from all over our State to discuss methods, &c.—many being the brightest of our successful farmers and agricultural educators—this subject was among the foremost, and became a settled matter that a farmer, to succeed with stock-keeping for profit, must have silos for ensilage, and that corn, grown to maturity or until the ears became glazed, cut into about 1-inch lengths (so as not to make sore mouths by cattle chewing shorter cuts of half an inch or so against the hard outside covering, as they would in their mouths bite or chew the short-cut stalk endways instead of sideways, and from sore mouths refuse food of any except softest, like mash). Corn thus grown produced the largest and most available tonnage per acre of any such adapted plant—not sowed thick, as farmers used to do, developing no sugar in pith for lack of sunshine reaching the roots of the growing corn—but, instead, drilled in rows of at least 3 feet apart, and not more than 8 quarts per acre for ensilage corn. Greedy farmers were bound to use more seed, and spoiled the food value and got less quantity per acre. The pith of corn, even near the roots, so grown, is found to be *sweet*, quite like sugarcane, and it is common to see cut stalks peeled and eaten with a relish like fruit: such growth makes fine ensilage.

Our common red clover makes fine ensilage—in fact, clover makes about the best balanced ration for stock that can be grown if properly cured as hay or made into ensilage—but the tonnage per acre has to yield in food value to corn: bean vines, pea vines, and all growths of that kind have been successfully cured for silage: but bother in feeding by forking, vines cling together so, and so has to be cut down with hay-knife process. Unless there is a fair development of corn on the stalk and mixed in the ensilage by cutting with ensilage machine altogether, which is the best use of the corn ears—some grain should be fed with ensilage—*bran* from wheat seems best, mixed with ensilage as fed, and salted as you would your food regularly each ration—not always practised, but stands to reason—and ensilage should

not be put in silo too green so as to become soggy and wet, for, although it thus becomes sour and smells disagreeable, cattle will be greedy for it; but it damages the milk in flavour, even to the *butter* made. Good silage will be damp, but not wet; the heating and fermenting cooks the whole enough.

Now, another stock-feeding economy coming into use by our best and most thrifty farmers is what is termed "Soiling." Nothing is better or more profitable where land lies favourable to practice. Cattle are kept in roomy shaded enclosures, and fed with fresh cut grass regularly in such fitted-up enclosures, in which fresh clean good water is abundantly supplied. The stock-feeder cuts his grass with an up-to-date mowing machine, rakes and hauls to enclosure of cattle, and feeds in racks. The cattle eat their fill, drink, and lie down, like "machines for making milk," or developing into beef or growth. No food is wasted or run off by exertion of animal seeking food; the food value of the land is husbanded, for cattle will tramp and spoil twice as much or more than they will eat, punching the roots dead, soiling by their droppings and discharges, which they will avoid in grazing; while in the other and better way, the yard manure in summer and stable manure in winter, being regularly drawn on to the meadows in summer and corn-ground in winter, gives *all* its fertilising value at once. The mowing machine cuts above it, and *all* the value is saved and utilised promptly.

There has been much discussion about the necessity of exercise for cattle to keep them healthy and vigorous, some saying *No*, others with argument saying *Yes*. There are, of course, extremes. If you watch a cow that is docile, kind, and has not been made afraid by rough treatment, you will see, after she is fed or taking water, that she will almost always walk off to some chosen spot and lie down, chewing her cud—a picture of content. Young stock growing—calves, &c.—will run, have frolic, and, if indulged too much, fall behind in growth and weight those of same grade kept reasonably restrained. The famous Holstein cow of Holland has been perfected by centuries of treatment to be the producer of the finest butter made, and in the London market commands highest price a cow making 25 to 30 lb. butter per week not being uncommon. They, from calves to slaughter-house, are never allowed beyond the length of their tether, are fed from the house like members of the family, as, in fact, they are. A "poor man's cow" in that country is valued on an average of \$300 (£60), for profit, I am told by an importer friend of mine—he was the one who imported Pauline Paul, the most famous Holstein cow on record. She had to be milked three times daily; her udder was like a wash-tub, so large and full. She was, of course, scientifically fed on balanced rations for milk and physical support (this balanced-ration business is now reduced to a practical application of theories and recorded facts, experiments for profit, &c.). I saw Pauline Paul several times when in the flush of milking; she simply could not have got her living and milk production wandering over even the best of pasture.

Senator Stevens, residing in Attica, New York, near us, had a large Holstein herd on his place. He had parlor cattle cars fitted up, and exhibited his stock all over the United States and won large premiums. He was wealthy, and this was then his fad. This was some years ago. Among his Holsteins, before Pauline Paul was a world-famous cow, were some splendid cows, whose records were not beaten until the development of Pauline Paul. All such stock were treated as I have described, and, of course, the ordinary farmer can *see*, but does not have wit or grit to follow as far as he *might*. Some *do*, and succeed.

I might add wearisome pages of tested experience in farming for profit. Laborious perseverance is the winner, and one must begin *young*, with an unyielding purpose. Wealth and fame will be the reward, with health—*all* tending to health—*healthy children*, useful and honored citizenship, walking in God's paths.

Cattle at the Grafton State Farm.

M. A. O'CALLAGHAN.

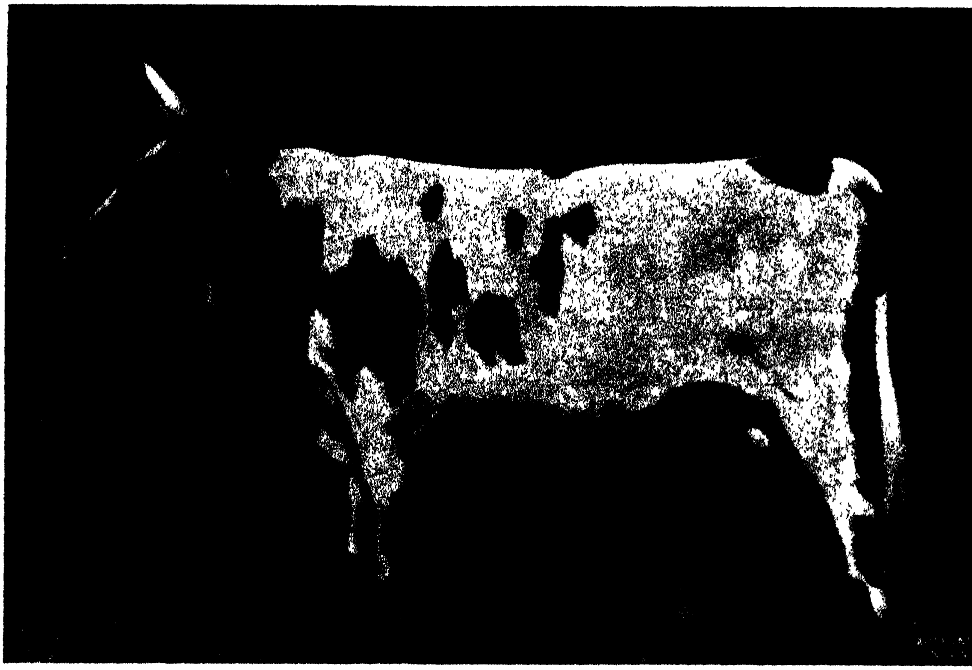
THE following snapshots of some of the bulls and cows at this farm will be of interest.

Guernsey bull—Gentle Prince—by Rose Prince (Imp.), from Gentle (Imp.). This bull is full brother to the young Guernsey bull Calm Prince, exhibited at last Sydney show, undoubtedly the handsomest bull of his breed ever seen in Australia. This picture does not do Gentle Prince justice, but it shows his great depth and constitution.

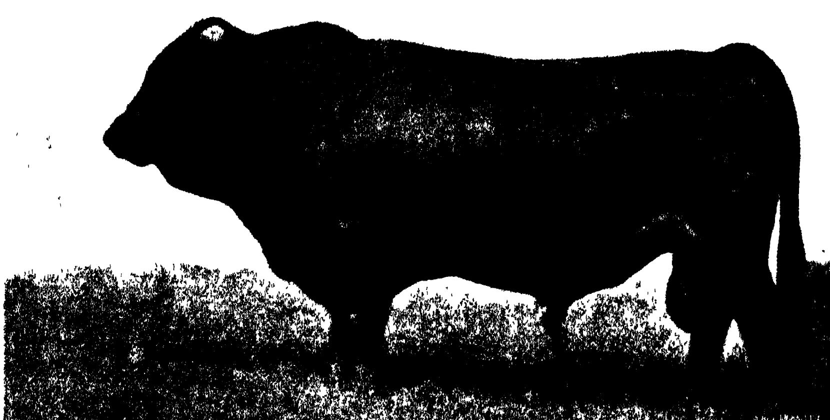
Guernsey—"Gentle Prince."

The Ayrshire bull, Peacemaker—by Mischief-maker (Imp.) from a cow imported from N.Z.—is a very typical animal. He has recently been sold to Mr. Barling, near Tamworth.

The Dexter bull, Waterville Punch (Imp.), is seen partly dehorned. He has proved a great sire, and his progeny, pure and half-bred, are wonderful milkers.



Ayrshire—" Peacemaker."



Dexter Bull—" Waterville Punch " (imp.)

Grading Dairy Products.

M. A. O'CALLAGHAN.

In July, 1897 (about three months after my arrival in Australia) a dairy conference was held at the Hawkesbury Agricultural College. The conference was convened by the then Minister for Agriculture, Mr. Sydney Smith, and delegates were present from the various dairy districts of the State, besides representatives of the produce houses of Sydney.

During the conference, a vote was taken on the question of grading butter by State officials. Feeling ran high, and practically every farmer present voted for the motion, the only votes recorded against it being by the representatives of the produce houses. There must have been considerably over one hundred in favour and only seven against the motion.

Needless to say, this overwhelming majority in favour of Government supervision of the export butter trade impressed me very considerably. The country and the people were new to me, and I had no prejudices one way or the other. As a consequence of this expressed desire of the producers, I expected that the legalising of grading would be but a matter of a month or two. Years went by, however, and the subject became a dead letter as far as legislation was concerned.

Dairying began to undergo a great change about four years ago; the farmers adopting, by degrees, the system of home separation, and instead of sending their milk daily to the factory they sent their cream one, two, three, or six times a week, according to their own opinions and conveniences. Needless to say, those who sent their cream daily objected to the once a week men getting an equal price. They also objected to the mixture of their fresh cream with the stale cream of other suppliers, trouble began, and the question of grading became a very live one once more. If grading was at all necessary in the days when milk was supplied daily to factories, it became doubly necessary now when creams of all ages and qualities arrived at the same factory for manufacture into butter. At that time very few indeed of our factories attempted to grade the cream, and as a consequence the quality of New South Wales butter suffered. The factory managers at this time had very unenviable positions. If they graded the cream they lost business, and got into trouble generally with their patrons, while if they omitted to grade the cream their butter was unsatisfactory in quality, and they got into trouble with the merchants, besides suffering a loss of reputation as butter-makers. It was only natural, under the circumstances, that they should desire to see some change, and at their annual conference they passed a resolution in favour of Government grading of butter by a majority of about twenty to one. They reasoned, and rightly so, that if the butter was

officially graded they would be able to grade the suppliers' cream without any fear of offending important shareholders. Thus, without losing business, they would be able to win back their reputation as buttermakers.

About the same time the newly-formed Dairy Farmers' Union were fighting the matter out in the several branches. The branches sent delegates to Sydney, and after a close contest the resolution in favour of Government grading was carried.

The Minister for Agriculture at the time—the Hon. John Kidd—was now pressed to introduce dairy legislation, which was to include the compulsory grading of all export butter and of all cream supplied to factories, the idea being to make it compulsory for factory managers to grade the cream, and to do the grading of the butter by experts, to be specially appointed for that purpose. It was calculated that about three men could do this, so there would be no army of inspectors, as the opponents of the measure stated.

A Second Conference.

The Bill was printed, but it met with extreme opposition from the majority of the butter merchants, and to satisfy a demand for further light on the subject the Minister decided to convene a conference of representative dairy farmers to discuss the whole question. The State was mapped out into districts, and each district was asked to nominate a delegate to attend the meeting. Meanwhile copies of the Bill had been freely circulated The delegates met in Sydney on 16th April, 1903.

The Minister opened the conference and the Bill was discussed clause by clause. Some slight amendments were made with the consent of the Minister, and finally the grading clause was reached. A long discussion ensued, and after thoroughly exhausting the matter a poll was taken, when the voting in favour of compulsory grading of export butter was something like twenty to two. The conference broke up, and at last it seemed that the subject would be dealt with by Parliament in a manner which would mean finality. The opposition became greater than ever from one quarter. Deputations from the exporters waited on the then Minister for Agriculture and on the Premier. Petitions were sent out from Sussex-street asking representative men to procure the signatures of farmers against the Bill. These met with varied success. Some were returned well-filled, while others came back without a single signature. The Bill was read a first time in September, 1903, and there it ended. The power of the seven votes of 1897 had grown and had influenced a great many others.

Meantime the State of Queensland, with a produce merchant and butter exporter as Minister for Agriculture, has passed into law a Bill almost identical with that which the exporters of New South Wales killed, a Bill that it will be seen was approved of by every conference and everybody whenever the question was fully and fairly discussed. The carrying of the grading question at the four conferences, viz., The Dairy Farmers' Conference, 1897, The Factory Managers' Conference, The Dairy Farmers'

Union, and the special dairy farmers' conference, convened to discuss the Dairy Bill in 1903, appeared very much like a mandate from the people, and knowing the educational value of the system of grading, I have constantly supported and explained the proposed scheme, whenever it was under discussion. Many farmers hold different views on the subject, but I may be pardoned for saying that I have had better opportunities of judging of the requirements of the industry, than it is possible for any single farmer to have. I have been actively engaged in every branch of the industry, and have been in close touch with the world's markets for years. I know from personal experience what the English market requiries. I know what other countries catering for the English market are doing, and the active parts the Governments of these countries are taking in this industry, and I unhesitatingly say that for the welfare of New South Wales dairying, some State supervision of exports is advisable—

(1) From the point of possible adulteration.
(2) From an educational point of view.
(3) From a commercial point of view.

Adulteration.

In discussing this we must bear in mind that New South Wales is the only country in the world with any dairying pretentions, that has not an Act of Parliament, dealing specially with the adulteration of butter.

Margarine Adulteration Acts, with very high penalties, are in force in every country where butter is made in quantity.

Apart from the question of adulteration by margarine, two new methods have recently been given to the world, viz.:—The adulteration of butter by the blending in of milk; and the Dutch system of adulteration, whereby a foreign substance to the extent of 28 per cent. is added to butter without being possible of detection by the consumer.

New South Wales holds a good reputation for the purity of its butter, and this reputation should be jealously guarded. "When the horse has gone it will be too late to shut the door."

Education.

Wheras the grading of butter as carried out in New Zealand greatly facilitates commerce, still the chief advantage of the system lies in its educational side.

It seems impossible to devise any more expeditious system of educating the factory managers, the factory directors, and the suppliers generally, than that of grading the finished product on its arrival at the port of shipment. This compels at once the strict grading of cream, and if the manager is given a free hand and is still unable to make good butter, then he too becomes graded second-class in the eyes of his directors. Finally the manager grades the cream, and by doing so he grades the farmer through his work, and if the farmer is unable to send good cream, there remains but one sensible thing to do, and that is to call in the aid of an instructor, who will put him right.

As we are situated at present, for the one farmer who invokes aid in the shape of instruction when his cream is graded second, five will take their cream elsewhere unless the factory is willing to pay them top price for this inferior cream. This is the weak spot in the industry. The strict grading of cream and paying for same in proportion to its quality might be termed the lungs of the entire organisation, or industry. If there is weakness here the whole system will be affected. Just as the lungs aid in the purifying of the blood, enabling the heart to pump pure blood to every part of the animal system, so the cream grader purifies the butter supply by preventing even an ounce of bad cream being pumped into the vats to contaminate the good. One pound of bad cream will in a few hours contaminate 10,000 lb., and by the time the butter reaches London the seeds of contamination will have grown and have spread decay throughout the entire box or boxes of butter. The great educational value of butter grading lies in the fact that the factory knows at once, and the farmer in a couple of days, the exact quality of the finished product. Therefore, the manager can put his house in order at once, and also inform the farmers concerned, so that, instead of sending an inferior article for weeks without a report, as is the case when the butter goes to London without examination, the inferiority can be inquired into at once, and perhaps checked before a loss of any great magnitude takes place. This has been the great factor in the wonderful improvement of the New Zealand butter industry. Give this Department similar facilities and I will guarantee a similar improvement in New South Wales.

Commercial.

This brings us to the value of grading from a commercial point of view, and in order to fully understand the readiness with which British traders buy butter on its grade it must be borne in mind that for quite a century England purchased the bulk of its butter on this system through the Cork butter market, where all butter was graded according to its quality.

The trustees of this market were granted a special charter empowering them to grade, and all contracts were based on this grade. New Zealand applied a somewhat similar system to creamery butter. Their graders have done satisfactory work, the result being that many of the big London and Glasgow houses are now represented in New Zealand, and these base all their transactions on the Government grader's certificate of quality. Last year, however, the matter was taken a step further, and the committee of the Home and Foreign Produce Exchange, London (the body that governs all sale conditions), added to their rules the following:—"That the Government grader's certificate of quality is to be final, and that the Government grader's certificates as to weights is also to be final." On the face of it, this proves that London buyers have found the New Zealand grading to be so reliable that they have decided it is to be the basis of all their contracts. This opens up an entirely new aspect of the grading question. Everyone who has any experience of the English butter trade is aware that great quantities of butter are purchased for supply to public and semi-public

institutions, and it would appear that unless New South Wales butter is graded this avenue of trade is to be closed to us, for merchants tendering for any such contracts cannot offer New South Wales butters. This, to me, is a very serious question, and it perhaps is responsible for the fact that two or three of the largest butter exporters in Sydney have recently applied to the Department of Agriculture to have certain lots of butter graded.

Objections to Grading.

The following are the objections I have heard made against Government grading :—

No. 1. That it is not possible to say how butter graded in Sydney will turn out in London.

Reply -New Zealand graders have been doing this successfully for some years, notwithstanding that they grade at five or six different ports, and that they make but fortnightly shipments. What New Zealand graders can do surely can be as efficiently done by graders in this State, where we have practically but one port of shipment. Also it should be easier to grade New South Wales butter, because, during the winter in New Zealand, the cows have to be hand-fed, and grass-fed butter is much less liable to change than hand-fed butter. Various experiments have been carried out by this Department which show clearly that, provided the carrying temperature is right, there is little fear for the work of a competent grader.

No. 2. That it injures the butter to open it in Sydney, and that it should not be opened after it is beaded down at the factory until it reaches London.

Reply. Under a proper system of grading, the factory managers would be compelled to put a mark on each separate churning, and then only one box from each churning would be opened, and this only in a cool room where the atmosphere would be such as not to injure the butter; also a little slip of paper is inserted into these boxes stating they have been opened for grading and inspection, so that a buyer would not take his opinion from those boxes alone. In connection with this objection it might be asked, "What about all the butter sold to British buyers in Sydney, and which is examined before purchase; and what about all the butter sent for sale in Sydney which has to be shipped to London for sale by the exporters;- is it not all examined first?

No. 3. That it is not the duty of a Government to grade butter, and that if it grades butter, why not wool, mutton, &c.?

Reply. This objection is but a mere quibble. What the duties of a Government are to its people is a matter for the Government and the electors. It might, however, be pointed out that almost every Government in the world is devoting special attention to dairying, and if by the aid of the Government our farmers can be helped towards success on the world's markets, then it seems a Government function to do so. In connection with

this the work of the Danish, Dutch, Russian, Canadian, American, German, French, Austrian, New Zealand, and Victorian Governments might be studied.

The second part of No. 3 objection is almost too weak to reply to. To compare wool and mutton grading with the grading of butter, an article that depends on a correct fermentation for its quality just as does beer or wine, seems childish.

In all industries where fermentation plays a ruling part, it is well known that a very small quantity of inferior stuff will ruin the whole. If a can of cream from a careless or dirty farmer is mixed with the creams of his neighbours, the whole mass is ruined, but if a poor lot of sheep are sent to market they cannot affect the quality of any others, and the same with wool. These substances are not blended together for final sale as are the creams of the farmers, and here is where the State comes in to protect the goods of the careful farmer being ruined by a factory manager mixing high-class with inferior cream.

The good farmer is thus deprived of some of his money quite as unjustly as if some one put his hand into that farmer's pocket, took some money therefrom, and handed it to the bystanders. The State prevents the one, therefore why not the other, if necessary.

No. 4. That butter grading would be an unjust interference with commerce.

Reply.—This objection is partly met by the reply to No. 3, because butter grading is the best and surest means of compelling the proper grading of cream.

However, if we analyse the proposed scheme it will be seen there is no interference with commerce in the proper acceptation of the term. Instead of an interference, the system has proved an aid to commerce in New Zealand.

Personally, I would not favour any scheme that really meddled with commerce, but I fail to see how the grading of butter which is the property of the farmers in any way can be called a commercial transaction. The work must be done by some independent body in no way concerned with the buyer or seller, and thus it is that it must be done by officials who are not dependent on the merchants nor on the factories for any part of their salaries. The only other way would be to appoint graders under a body of trustees, their salaries to be paid by a small tax put on each box of butter. At present there is some such tax, although the farmers may not know it, because two or three gentlemen in Sydney are acting as private graders or inspectors, their services are at the disposal of merchants, and are availed of when required.

One big exporter said to me, "I have to pay for inspection now, and I would much rather pay a Government official by placing a small tax on each box. The work would then be more satisfactory to all concerned."

New Zealand butter is all graded; next season all Queensland butter exported will be graded compulsorily; Victoria did a lot of voluntary grading

last season, and it is very probable that the system will become compulsory there very soon; this will leave New South Wales as the only part of Australasia that the rule recently made by the Home and Foreign Produce Exchange will not apply to, and ours will be the only butter that cannot compete for contracts under those conditions. I do not, in any way, wish to endeavour to force this question on our farmers, but I would suggest to them that the whole matter wants reviewing. It is worthy of their best thoughts, and, if desired, I will be pleased, with the consent of the Minister for Agriculture, to visit any dairy centre in New South Wales and deal with the question in a dispassionate manner.

Resolutions adopted at a meeting of Butter and Factory Owners and Managers, 16th December, 1895.

That, in the opinion of this Conference, all butter for export should be examined, graded, and branded by a Government expert before shipment; if possible, at a common centre.

That, in the opinion of this Conference, a Government official, properly qualified, should be appointed in London to watch the interests of produce shipped under Government auspices.

Resolution adopted by the Executive Committee of the Dairy Farmers' Union of New South Wales, 1st July, 1902.

That, in the opinion of this Committee, the Government grading of butter, on similar lines to that in force in New Zealand, is necessary to protect the interests of the producers.

Resolution passed at the Dairy Conference, 1897.

That it is desirable the Government should inaugurate a system that will ensure a supervision of the marketing of our produce in Britain, either by co-operating with the Governments of the various Australian Colonies, or in such a manner as may be deemed advisable.

Dairy Notes.

M. A. O'CALLAGHAN.

Butter Adulteration.

The news of the Dutch butter frauds has set people thinking on this subject. Some think no harm is done to Australia so long as the "faked" butter is not sold as Australian. Let us analyse this view of the question. Australian butter is bought in England at, say, 105s. per cwt., sent to Holland, blended with other substances, and exported to England, where it is sold as Dutch butter at, say, 95s. per cwt. This creates a new avenue for our butter, and if the *fraud must continue*, and somebody's butter must be used as the basis of adulteration, then it matters not so much whose butter is selected by the clever Dutchmen. However, there is another aspect of the case, and it is this: Is the dairy-farmer to be superseded to a great extent by the dairy chemist. On this occasion one chemist or his work is equal to about 50,000 farmers, or, on the English butter imports, a money value of about five and a quarter millions sterling, as England imports about £21,000,000 worth of butter per year. If by means of adulteration a quarter of this is to be supplied by fat other than butter-fat, then the occupation of a good many dairy-farmers is gone unless the low price at which the adulterated article is sold causes a 25 per cent. increase in the amount of butter eaten. This is by no means likely, though it is only natural to assume that some increase in consumption will take place.

Another view of the case:—Let us suppose that *all the butter* shipped from Australia to England shall be purchased for this faking "business," what then becomes of the reputation which Australians have taken years to build up? What becomes of Australia's present position on the butter map of the English grocer? If they would take only inferior butter for this purpose all would be well from this point of view, but for such purposes, as is the case with margarine manufacture, I imagine that only good butter is desirable, as ill flavours are hard to get rid of. The best policy for every country to follow is to put its own name on every good thing it turns out, whether it be cricketers or butter. Every pound of good Australian butter that is withdrawn from sale leaves Australia misrepresented to that extent. The more good butter we can place on the market the greater will be our influence on trade, and greater the desire to trade with us.

There is still another aspect of the case. The Dutchmen are offering the secret of the process of adulteration in England and Ireland. Are we to assume they will stop there? Australian butter best lends itself to this form of adulteration. Therefore, we might reasonably assume the secret will be offered freely in Australia. There is no special law against butter adulteration in New South Wales.

Hawkesbury Agricultural College and Experimental Farm.

Broom Millet.

[Continued from p. 586.]

GEORGE MARKS,
Experimentalist, Hawkesbury Agricultural College.

Bending down the heads.—The practice of bending down the heads is not carried out extensively in this State. In some parts of the United States of America this operation is never neglected. When allowed to grow in the natural way a large percentage of the brush will spread out and bend over on account of the weight of the seed, and thus reduce its marketable value. This is especially the case if there is good rain when the brush is forming. The rapid growth causes the panicles composing the head to become tender and unable to bear the weight of the growing seed. Strong winds at this particular period will also cause this, and grain-eating birds when plentiful are sometimes responsible for a great deal of damage. The illustration shows a sample of the brush, thus described.

An instance where artificial bending-down would have been profitable.

This loss may be prevented by bending the stem over, and the weight of the seed in maturing will cause the brush to lie close and straight. The turning must be done between the joints or nodes.

as if done on the joints the stem will snap and the top die off. The bending checks the flow of sap a little, but the growth in the head is not materially affected. This operation is performed when the seed is beginning to fill out, and the brush shows signs of spreading.

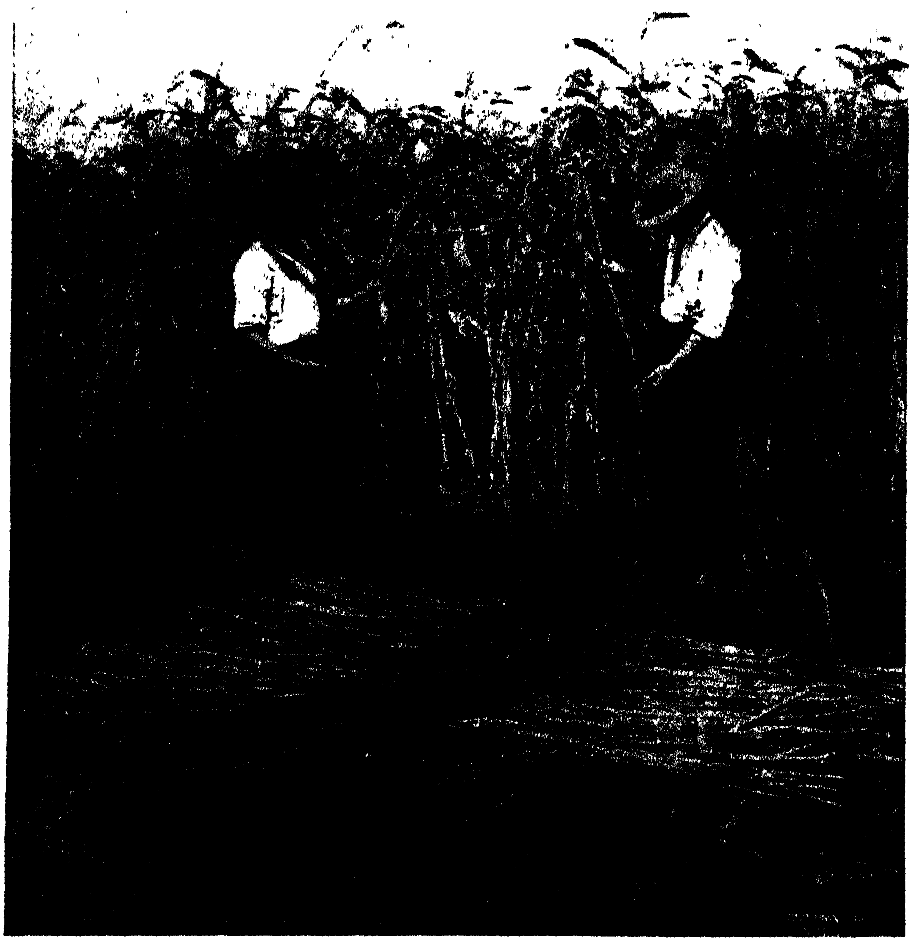
A crop of neglected Millet.

It should be understood that it is quite possible to grow millet without turning down the heads. Some of the best millet on the market is grown by farmers who do not favour the operation. At the same time, there are seasons when a fairly large percentage of millet is completely spoilt, when such losses could have been prevented by the adoption of this system. The stalks are bent about a foot below the base of the head, and if the plants are very tall there may be two bends, as shown in the illustration. The heads should hang clear of the ground, so that they will not be damaged by rubbing, or discoloured by the splashing of mud in rainy weather.

Harvesting and curing.—No matter what care has been bestowed upon the cultivation of the crop, sound judgment must be exercised at time of harvesting. An excellent crop may be brought successfully as far as this stage, and yet the result may be unprofitable on account of inattention to, or ignorance of, some apparently unimportant detail. The time to harvest, and the various other operations required to prepare the millet for market, are such as require some experience in order to do them properly. Even experienced growers are not unanimous on the point of when to harvest the brush, some cutting the heads when in blossom, and others harvesting later so as to obtain better developed seed possessing considerable nutritive value. The time to cut the heads will depend upon the weather and the colour required. Manufacturers generally prefer a millet having a green tinge. It is then much tougher than when allowed to become nearly ripe. To obtain this green colour the millet should be cut when the seeds are in what may be called the dough stage. The brush is then fully developed, but the grain is soft. For some classes of goods a golden colour is preferred, in which case the crop is left till the grain is fairly firm. With a little experience it is easy to harvest a large area and yet maintain a uniform tint. A strong knife (a pruning knife is very suitable) is used to cut the brush, and at least 6 inches of the stem should be left on it. With dwarf varieties the brush may be pulled instead of cut. Select fine weather for this operation. Some growers bend the stalks of drills towards each other diagonally, about 3 feet from the ground, forming a sort of platform upon which the cut heads are placed to dry. Others cut the whole of the stalks and lay the millet upon them. The former method is the better, as there is a free circulation of air and the brush dries more quickly.

A stalk of Broom Millet with the head turned down.

Drying in the field.—In this State the millet may be properly dried in the field during the greater part of the summer months. Should thunderstorms occur, the brush must be placed in heaps and covered with tarpaulins, sheets of iron, or other material. The time required for drying depends upon the season, but with fine, bright weather two days should be sufficient. The brush must not be allowed to get wet, as rain or dew soon discolours it.



Drying Millet in the field.

Drying under cover.—The finest colour is obtained by drying the millet under cover or away from the direct rays of the sun. The millet is left a couple of hours in the field for some of the moisture to evaporate before taken to sheds fitted up with racks one above the other so that the brush may be spread out in layers about 3 inches deep. It must be turned regularly every day, and when nearly dry may be placed in thicker layers. This method requires a good deal of attention and plenty of space, and the brush takes a much longer time to dry.

Removal of the seed.—The seed is then removed by means of a hackler. This consists of a roller studded with small iron spikes, the whole being mounted in a frame, and is made to revolve at a high speed. The top of the frame is 3 feet by 2 feet, and is supported by four legs 4 feet 6 inches high, the timber used being 3 inches by 2 inches. Machines may be obtained in Sydney for £3 17s. 6d., hand-power, and £1 extra for horse-power; but a handy man may construct one at a very small expense. The following description of a home-made stripper is taken from particulars supplied by a large grower of millet on the Manning River, Mr. A. J. Newby, and with such apparatus he has for many years successfully treated his brush.

Covering Millet over with tarpaulin to protect it from rain or heavy dews.

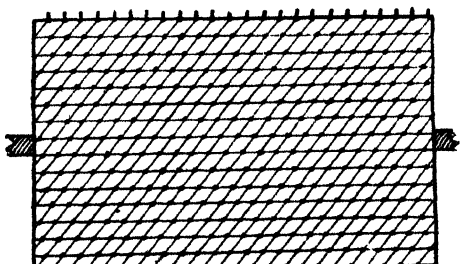
The roller of a hand-power machine should be made of a tough piece of wood 18 inches long and 15 or 18 inches in diameter, and to guard against splitting a light ring may be placed on each end and securely fastened with screws. Stout nails with their heads cut off are then driven at regular intervals into the roller, leaving a small space between each. An iron spindle passes through the roller and fits into bearings on the frame. At one end is fastened a fly-wheel, and at the other a 3-inch cog-wheel. Fitting into this is another cog-wheel 2 feet in diameter, to which is

attached the handle. The roller is cased in on each side and at the top. Ample speed can be obtained by turning the handle thirty times per minute.

Grading.—The grading of millet is most important, and must not be overlooked. The crop may be sorted into different classes, according to

A small hand-power Hackler used by Students at the Hawkesbury Agricultural College.

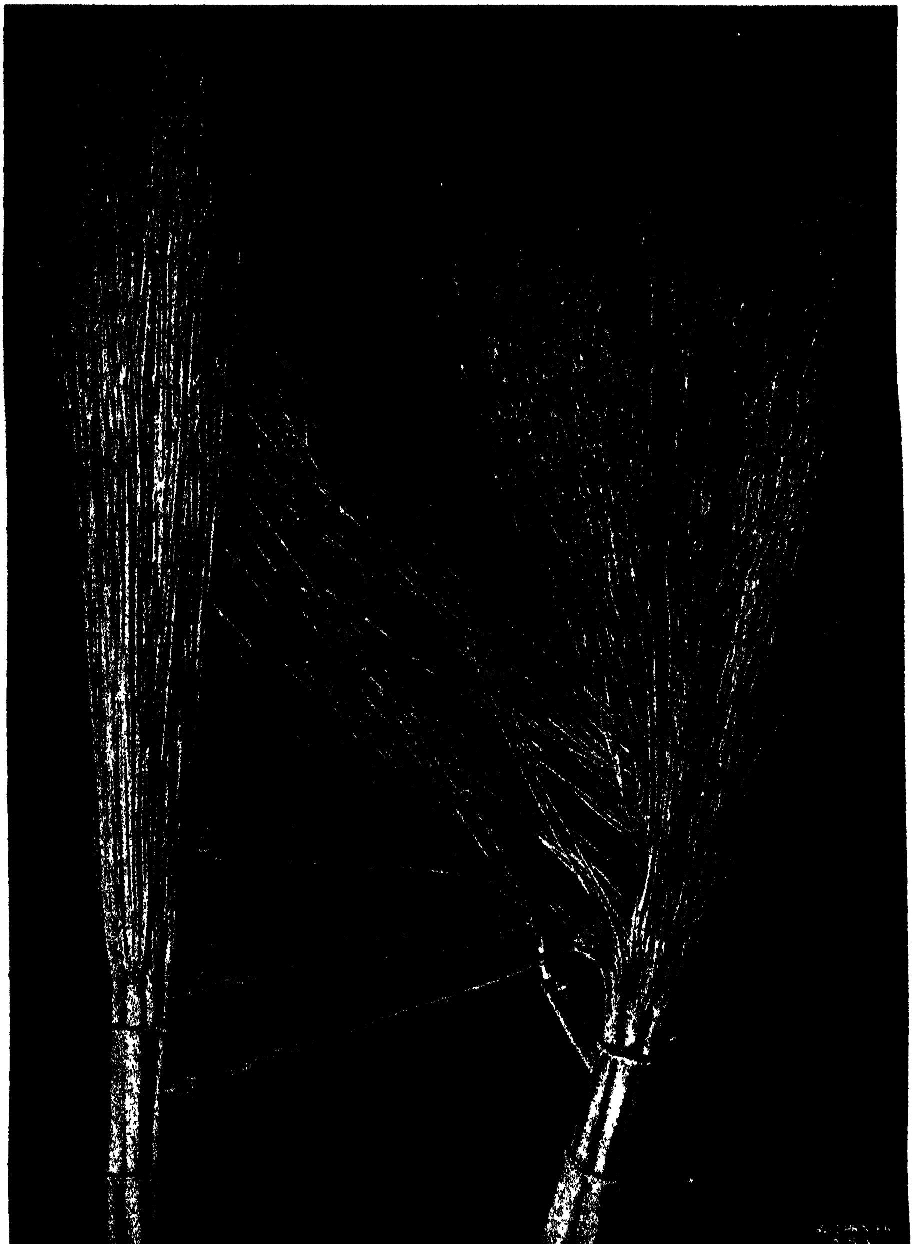
colour, length, and fineness; but broken millet should invariably be discarded.



Wooden roller of home-made Hackler, showing how the nails or pins are arranged.

Baling.—For this purpose a press is required. One used for baling lucerne or other hay can very conveniently be adapted for this purpose. It is important, especially where space is charged for in freight, to reduce the bulk as far as possible. The brush is laid with butt ends outward and the heads overlapping in the middle. Two battens are placed at the bottom and two on the top

of each bale, and when pressed the whole is secured by five fairly stout wires. The size varies with different growers; but a bale 46 inches by 30 inches by 24 inches, and weighing from 300 to 400 lb., can be recommended. Each



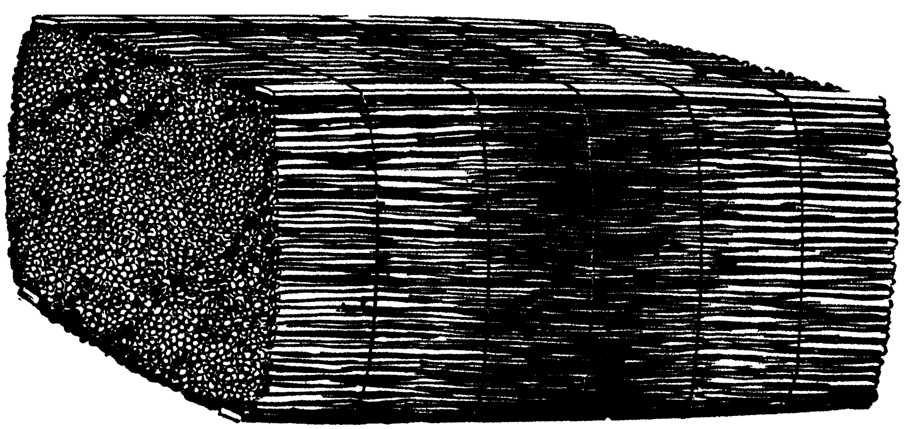
a b

a—A good sample of brush. *b*—Sample of brush from a neglected crop.

bale should be legibly branded with an indication of the quality. There are several styles of home-made presses in use, but one that is coming largely into favour is made on similar lines to a wool-press, having a lever and wire ropes.

Selection of seed and varieties.—Special attention must be given to the selection of seed. That obtained in the process of stripping is only suitable for feeding to pigs and poultry, and should not be used for sowing. Small plots of millet may be grown, or individual plants left in the field and allowed to ripen their seed. In either case, only those plants should be left which produce the best brush, and these must be carefully marked. When ripe, the seed is harvested, cleaned, and put in a safe place for next season's sowing. Where birds are troublesome, it will be necessary to cover the heads with some light material, such as muslin, as soon as the seed is commencing to fill out. The ends should be tied loosely around the stalk, so as to allow of free circulation of the sap.

There are several varieties of millet on the market, but the White Italian has up to the present given the best results. Other good sorts are Californian and Dwarf Evergreen. Growers are advised to grow small



A bale of Broom Millet.

areas of new varieties from time to time, or to introduce fresh strains of those kinds they have in constant cultivation, with the view of finding out what particular sort or strain is most suitable to their particular district. By proper selection of seed the yield of any particular variety can be greatly increased.

The stalks are generally dry and woody at the time the brush is harvested, and on that account little use can be made of the crop for feeding purposes beyond allowing stock in for a few days immediately the broom is harvested. The refuse should then be cut up with a heavy disc harrow, or cornstalk-cutter, and ploughed under for manure.

Yields.—The yield ranges from 8 to 12 cwt. of clean marketable brush, and 25 to 30 bushels of seed per acre. The prices vary from £18 to £40 per ton for the former, and, if not consumed on the farm, the latter is worth about 4s. per 4-bushel bag.

Prospects.—Regarding the prospects of the broom-millet industry, Messrs. Foster and Sons, of Sydney, who handle large quantities of millet annually, state:—"The total quantity imported during the last three years would not average more than 50 tons; but about five or six years ago, before the crop was extensively grown here, manufacturers had to look to the imported article for fully three-quarters of their supplies. This year very little will be imported, whilst fully 300 tons will be exported to the adjacent States and New Zealand. Last year when the season opened, the price ruling was £22; but it closed with a market rate of £40 per ton. Although a few bales of very early millet this season realised as high as £40, we may safely say that the market opened at harvesting time at £22, and shows every possibility of reaching £30, as the export demand is active, and the local manufacturers are also operating freely. With regard to the question of over-production in a plentiful season, we think it will be time enough to deal with this when it arises, which we do not expect for some years yet, inasmuch as Victoria and the other States are lessening their imports from outside of the Commonwealth and increasing those from New South Wales. Then, again, if the millet is properly cured, it can be stored for two or three years if the prices are too low, and no injury is done to it whatever. Referring to the cost of production and returns, one farmer on the Manning stated recently, 'That he would rather grow millet at £16 per ton than maize at 2s. 6d. per bushel.'"

On almost every farm the implements required to plant and cultivate the crop are found. It will not pay the farmer to obtain the apparatus necessary to treat his brush, unless he intends to grow the crop for a number of years. When prepared to do this, and he produces and sends to market millet of the very best quality only, the growing of broom millet will be found a very remunerative undertaking. In districts where freights are considerable farmers should co-operate and establish small factories, where the whole or portion of their brush could be profitably made up into brooms for supplying the local market.

Ducks and Duck Farming.

[Continued from page 443.]

D. S. THOMPSON,
Poultry Expert, Hawkesbury Agricultural College.

II.

The Indian Runner Duck.

The Indian Runner duck is quite a new breed, and is now only just making its way into popularity. Only a few years ago this duck was unknown amongst breeders in any part of the world. Within the last

decade they were shown at the Crystal Palace and dairy shows in England. Since then they have classes at every popular show in England and Australia, but have met with very little success in America.

The breed is becoming very popular in Australia, and before many years have passed will be the most popular duck in Australia, and the most largely bred. Only a few years ago, one of our Australian poultry experts wrote, "Indian Runners may be called an ornamental duck, and are not likely to occupy a prominent place in breeding for profit," and in the face of this we have just penned the prognostication that in a few years it will be the most popular and the most largely-bred of any duck in Australia.

Duck. Drake.

Indian Runner Ducks.

It is a most remarkable thing, but nevertheless true, that in modern poultry culture in the evolution of new breeds and varieties, a breed of fowls or ducks win their way into popular favour, and are very extensively bred, before anyone knows anything of the process of their development. And it has been so with the Indian Runner duck. They have been taken up by the fanciers of England and Australia, and now that people are beginning to breed them largely, they are anxious to know from whence they have sprung.

Like the Brahmas, the Leghorns, the Spanish, the Minorcas, the Cochins and so on, there is a legend attached to them of their having come to England from over the sea. The tale is that some sea captain brought some ducks from India to Whitehaven, and made a present of them to some friends of his in Cumberland, and for many years they were confined to that county and were largely bred, although it was only recently that they were exhibited in the show-pen at Kendal, where they attracted great attention from other fanciers from other parts of England, who listened to the tale of their first importation, and in a short time they were exhibited at the Crystal Palace Show and the Dairy Show, both held in London, and afterwards at Birmingham and other leading poultry shows throughout Great Britain. It would not add to the value of the duck now whether it was proved to be imported from India or "made in Cumberland," but we have no hesitation in stating that our opinion is, that they were made in Cumberland.

Ducks like Indian Runners can be made or developed from Pekins and Rouens. Breeding systematically from Pekins and Rouens, the further away from show quality the better, you can produce plain fawn ducks, wrongly called buff, and also plain blues or greys, and if you follow this up by still crossing with the white drake, you will get magpies, more or less akin to the markings of the Indian Runner, and it is a fact that a few years ago the Indian Runner was to be found in both colours, fawn and grey, and to-day we have the plain fawns, known as Buff Orpingtons, and the plain greys, known as the Blue Orpington, which have undoubtedly been developed from the Rouen. Also many a time in our wanderings we have come across common ducks (common ducks are so called from being bred indiscriminately) which were either plain fawns, and would pass to-day for Buff Orpington, or plain greys, which would pass to-day for Blue Orpingtons, and in some cases ducks of magpie markings, although we never did see them of the exact markings of the Indian Runner of to-day, although it is possible that the colour-marking of the Indian Runner has been fixed by breeding for uniformity.

The great poultry authority, Lewis Wright, undoubtedly the greatest poultry-writer of the world, in treating of Indian Runner ducks, accepts the version of the account given by Mr. J. Donald, of Cumberland, of the importation from India by some unknown sea captain, and the great English authority gives it as his opinion that of the two colours, fawn and grey, the fawn, was the original colour, and the grey produced by the crossing of the fawn with some other colour of local stock, and he accounts for the claret breast of the drake and the ribbon-marked wings as having come from the same crossing, while we feel inclined to put it down to atavism, proving our conjecture of the Indian Runner having been made in Cumberland, from a white and Rouen cross.

That the breed has in some way sprung from the Mallard, there is no gainsaying, so that the question at issue is simply whether the breed was developed in India or in England. Mr. Wright, himself, tells us of Fawn ducks or Khaki Campbell ducks, and blue or grey ducks, as having been developed in England, and he tells us that the late Mr. Feeball, several times told him, that in 1860 there was a locally recognised blue duck in Lancashire, and Mr. Wright goes on to explain that ducks, more or less of that colour, could be produced by crossing white with the Rouen, and that blue ducks are found in northern Europe with white throats, like the Indian Runner.

Then he goes on to describe the Campbell ducks, so called after the name of their originator, Mrs. Campbell, of Whey, in Gloucestershire. These ducks are nothing more nor less than those now called Buff Orpington. Lewis Wright calls them the Khaki Campbell duck.

Mr. Harrison Weir, in *Our Poultry*, describes the Penguin duck and the Indian Runner as two different breeds, but of closely analogous varieties, and he is inclined to believe that the Penguin ducks, which he saw at the Surrey Zoological Gardens, in the thirties, were the same ducks, that are now exhibited as Indian Runners.

The late Mr. Henry Digby, England's greatest duck breeder, who took up Indian Runners after they were exhibited at Kendall, in writing on Indian Runner ducks, tells of the difficulty he and others had in getting any of these Indian Runner ducks from India; but he states, in 1898, he succeeded in procuring a trio from a friend in Calcutta. Now, as Indian Runners were in Australia in 1896, imported from England, there is no reason why they could not be in Calcutta in 1898, also imported from England.

In A. J. Compton's "Australasian Poultry Book," Mr. Harold Cadell, writing on Indian Runners, says:—"The bird seems to be extinct in India. Efforts have repeatedly been made by British fanciers to obtain fresh birds, but unsuccessfully." If Mr. Cadell is right in saying that the bird is extinct in India, then we would have no hesitation in saying it never existed there. We are very much inclined to believe it is like the "Indian Game" of Cornwall.

On the advent of Indian Game in Australia, one of our Australian fanciers at once cabled to India for Indian Game, so as to be in the van, and he got them; but they were "Indian Game," or what we call "Aseel," and not the Indian Game he wanted, which were made in England, the country to which he ought to have sent. So far, we have heard of no one cabling to India for Indian Runner ducks, and if they did we are not inclined to believe that they would get the Indian Runner duck which they wanted. However, be that as it may, whether evolved in India or England, the Indian Runner is a duck which is more than a credit to the country of its origin.

In May, 1896, not yet ten years ago, the first two trios were landed in Australia. Mr. Harold Cadell, of Wotonga, Beecroft, was the importer. The ducks were kept at Wotonga and bred from for a few years, Mr. Cadell giving up breeding them, not because he found them in any way unsatisfactory, for he wrote of them in "Compton's Poultry Book" in this strain:—"Their chief points are: great foragers, travelling all over the paddocks in search of food; early maturity, laying at four months' old; very hardy; non-sitters, and layers of an immense egg for the size of the duck. They are rather small, 4 to 5 lb. being the average adult weight when alive. In fact, they occupy the same position amongst ducks as the Minorca does amongst fowls—the best of layers. The Runners are not classed amongst the table varieties, as they are small and do not put on flesh as readily as Pekins, Aylesbury, or Rouens; but those who prefer a wild Black duck on the table will find an excellent substitute in the Runners; we find them all that can be desired. They came to us with a tip-top record as layers and have fully maintained their reputation; the discovery that they were such edible birds is still another point in their favour."

This glowing report, written by the first importer of the breed into Australia, was sufficient to boom them, but just at that time they did not catch on, and their progress was somewhat slow for a number of years. During the last five years the increase has been very rapid; they are now just on the point of having a successful boom in Australia, particularly so in our own State. To-day the interest of the

great bulk of our poultry-breeders lies in the production of eggs, and when the true merits of the Indian Runner are fully known, they will be very largely bred for the production of eggs alone.

Many authorities quote them as laying up to 300 eggs per annum, and while the maximum of 300 is reached, it is only in isolated cases; but still the phenomenal laying powers have been amply demonstrated, not only in private yards, but also at the public Duck Egg-laying Competition, which is being conducted at Blackwall, under the auspices of the *Australian Hen Poultry Journal*, and when the final totals are published it will be found that Indian Runner ducks can put out an average of over 200 eggs per annum each, equal to the very best production of our best breeds of hens; and as the eggs they lay are 30 oz. to the dozen, there is no fear of them being rejected for being under size or otherwise unmarketable. There is a good demand for duck eggs on the market, and they often top the list by 1d. per dozen over the highest quotations for hen eggs.

There is no doubt that if this variety is systematically bred for egg production, by trap nests and breeding from the greatest layers by selection, they will respond by giving a larger output per annum than any domesticated variety of poultry. The Indian Runner is an excellent duck in many ways; it is very pretty and very clean. They are not so fond of puddling as most ducks are; but, if given a free range, or even a fair range, they will keep working all over it, grazing and hunting for insects, instead of wasting their time swimming around and diving about in a pond.

They are great foragers, and are easily kept; they are small eaters, and are very hardy, easily reared, and at a low cost. They do not sit, but that is in their favour, for, with incubators and brooders, there is no necessity for it; consequently it would be possible to breed thousands of this variety without having a sitter of any kind on the premises.

Although incubation and brooding will be treated on exhaustively in a later issue, it might be as well to mention here, in connection with our advocacy of taking up the Indian Runner duck for profitable farming, that they can be more cheaply raised than any variety of poultry, and will give greater monetary returns; they are more easily bred, easier to hatch, and easier to rear than any other kind of poultry. In artificial incubation they hatch out well, and are easily reared in brooders; there is no disease amongst them, and, with proper appliances and sufficient care and attention, thousands can be reared with an infinitesimal percentage of mortality. There is nothing more comforting than to be able to rear almost every bird you hatch, and you can get nearer to this happy state by breeding Indian Runner ducks than you can by breeding fowls, more particularly when you get into big figures. Artificial incubating and brooding is getting more and more perfect, and to-day we have just heard of a device from Victoria, which, if successful, will revolutionise poultry-farming. While we have always considered incubators to be quite up to natural incubation, we have always looked upon artificial brooding to be many miles behind. The reason for this has always been in the difficulty of

regulating the heat, and nothing kills faster in the ornithological world than sudden changes of temperature, either natural or artificial, but much more so the latter. With incubators the heat has been always more easily kept uniform by the assistance of miscalled self-regulators; still, if they were not self-regulators, they were of great assistance in keeping the machines running at a uniform heat, but not so with the brooders. They have no regulators of any kind, and it is most difficult, even with the most experienced, to keep the brooders running at a uniform temperature.

It is more necessary to run the brooders evenly than the incubators, and yet the incubators have had the most attention and been the most perfected. But with this Victorian invention, if successful, there will be no further difficulty in maintaining a uniform heat in both incubators and brooders. The device is known as Law's Electric Regulator, and if it acts as a complete self-regulator, it will be an invention of the greatest value. From an account of it given in the *Agricultural Journal* of Victoria, May, 1905 (where also a plate of the invention can be seen attached to an incubator) it is explained that the electric battery is worked from the thermometer; immediately the thermometer registers 103°, the current operates and reduces the heat. This invention will be even more valuable for brooders than for incubators. With this invention perfected, one of the elements of uncertainty is removed from duck-farming.

The Indian Runners have been bred at the Hawkesbury Agricultural College for eight or nine years, and they have been found to be exceptional layers with us, although we have never been able to create a large yard of them, as the demand for them has been so great.

We are now endeavouring, if we can find the ducks, to purchase a number of them, and at the same time stop all sales of birds and eggs of this variety, and try to breed up to, perhaps, 1,000 ducks, with a view of testing their egg-laying capacity in vast numbers.

In England they are well spoken of as egg-producers, the late Henry Digby speaking of them thus:—"They surpass all other breeds of ducks as egg-producers, and experience shows that they begin laying earlier in the season, and also continue to lay later in the season, than any other duck." Mr. Simon Hunter, Secretary of the English Utility Poultry Club, and who was enthusiastic enough in his study and advocacy of egg-production as to pay the Hawkesbury College a visit to inspect our methods of egg-production in connection with the Egg-laying Competition, speaks of the Indian Runner as follows:—"They are decidedly the best layers of any breed of ducks, often commencing to lay in the autumn and laying all through the winter without a break. We have kept the breed for nearly twenty years, our stock being descended from a duck which laid close upon 300 eggs in twelve months. They are non-sitters, and lay a large egg for the size of the bird, which is rather small. Our strain breed true to colour."

We have already given favourable reports of them from England and Australia: now let us see what the opinion of them is in America. The following was published only a few years ago in the *Reliable Poultry*

Journal of the United States:—"The Indian Runners are particularly adapted to the market poultry-man's needs, as their wonderful laying qualities ensure an almost constant supply of eggs. Their small size, when first introduced into this country, was against them; this, however, by careful selection, has been almost entirely removed, so that now a pair ready for the table, or rather dead and plucked, will weigh 10½ lb., with rich yellow flesh, very firm in texture, and full deep breast. This, it must be admitted, is not only a good marketable weight, but also is quite large enough for the ordinary diner, and furthermore is of a finer quality of flesh than the larger and which are erroneously considered better on this account." So that wherever this duck has been bred it has made a good name for itself, and we predict a lasting name.

When the Indian Runners were first shown in our exhibitions, they were shown in the two colours, fawn and grey, but it is seldom we see a grey specimen now. At first our judges were not too sure of the correct colour and markings, so that the judging was erratic for a time, but it is now generally understood what the colour and markings of an Indian Runner drake and duck should be. As there has not been much published about this variety, perhaps it would be well for us to give here a full description of the Indian Runners. We cannot do better than give the description of them given by the first breeder of them in England as a breed, and who has the honor of bringing them before the public, viz., Mr. J. Donald, of Wigton.

Mr. Donald thus describes them:—"Both duck and drake should be close and tightly feathered, with very erect carriage; compared with other ducks they are small, their average weight being from 3½ to 4½ lb. each. They are alert and sprightly, with very active habits, nearly always being on the move. The head is fine and comparatively flat, and the eyes high up in the head. The bill is very strong at the base, broad and long, coming straight down from the skull, giving it a wedge-shaped appearance. The neck is long and very fine, a characteristic which is seen in its greatest perfection during the spring months, more especially in ducks when they are in full lay. The body is long and narrow, elevated in front, and the head carried high, giving a peculiar erect carriage when on the move; but the carriage is not so much of the penguin form now as it formerly was, and whether this effect is owing to climatic changes and influences, the introduction of foreign blood into so many strains, or to in-breeding, it is difficult to say with accuracy, but probably they have all shared to a greater or less degree in producing this effect. The colour of the head is a faint fawn in the duck, and a bronzy green in the drake, with a narrow band of white running round the base of the bill, at its junction with the head, in both the duck and the drake. The bill of the duck is a dark cucumber shade, while the drake is more of a yellowish-green. The coloured parts of the body of both duck and drake are of a soft fawn shade, that of the drake being finely pencilled, and giving it a somewhat deeper reddish-brown tinge towards the upper part of the breast, while the feathers of the duck have a brownish centre on each feather, and a fine lacing of a lighter

buff shade at the margin. The upper part of the tail and curl feathers of the drake are of a darker shade, somewhat resembling the colour of his head."

Mr. Donald adds:—"In selecting breeding stock, only sound, coloured birds, with long fine slender necks, and erect carriage should be chosen as indicating purity of race."

Here, in our opinion, Mr. Donald can find the reason for the change of type which he speaks of in the birds losing their erect carriage; the gait of the Indian Runner is artificial, and unless Mr. Donald's advice is followed in the selection of erect carriage birds, the type would soon revert to the more natural carriage of the ordinary duck.

Lewis Wright, in his description of the Indian Runner, says:—"The Indian Runner is a small duck, the drakes only weighing 4½ to 5 lb. each, and the duck weighing a pound less. The plumage is very close and tight, making them appear rather small even for their weight. The head is flat, making the eye appear near the top of it, and the head very long and fine looked at sideways, and the bill, which is thick at the base, comes out very long, in the shape of an almost straight wedge, dishing or concavity being a fault. The neck is long and thin, and the whole body also long and slender, the breast having no keel and being carried high in front, as also the head, on legs set far behind. In this attitude the bird does literally run quickly along the ground. The legs are fine in tone and orange-red in colour. In colour two schools are recognised, the fawn and the grey; but there is very little doubt that the fawn is the original colour, and the grey the produce of crossing on local stock, which has, however, been since bred true to type in other respects. The bill is yellow, when hatched, but gradually becomes green, the drakes being of rather a more yellowish shade than the ducks. The head has a dark cap, divided by a white line from dark cheeks below the eye, which are separated by another white line from the base of the bill. The neck is white to about an inch above the shoulders, from whence descends a coloured breast below, and on the back is a large heart-shaped patch whose point reaches to the tail. The tail and posterior end are coloured. The fluff and under parts are white, up to the coloured breast, which commences about half-way between the legs, and the point of the breast-bone. The tail of the drake is darker than the rest, whether grey or fawn, the colour should be as uniform as possible all over, and pretty sharply cut where it meets the white. From the crossing which has taken place, breasts almost claret, and even ribbon-marked wings are sometimes found, but any such signs at once stamp the stock as impure. Indian Runner ducks are too small to rank as good market ducks, but, when killed young are deliciously tender and juicy, with fine flavour, and pay well for home consumption. They are not fit for confinement, in which they fret and do not thrive; nor are they very fond of swimming, just one bath daily at the utmost, seeming to satisfy them. Their propensity is to wander all over a farm in search of animal-food, and on a good range they often do not care even to wait for feeding in the morning, preferring to be off all over the fields; but will return for a little grain

of some kind at nights. They very often begin to lay at 4 months old, and quite ordinarily will lay on this regimen, 120 or 130 eggs per annum, often laying right through the winter. They lay well till 7 or 8 years old, and if not more than five ducks are kept with one drake, the eggs are very fertile. The eggs are white in colour, and average five or six to the pound, being large for the size of the birds, and quite delicate in flavour. The young grow very fast and are quite hardy."

As regards the descriptions of the different leading authorities of the colour of the Indian Runner, as the whole three of them are very close to describing the same actual markings, we would like to point out a small, though rather important, divergence in two points, one in relation to the bill and the other in relation to the colour of the cap on the head. In reference to head and bill, Mr. Harold Cadell, the first importer of them into Australia, says—" A little black round the head of the drake, with a greenish-yellow beak. The beak in the duck being dark green."

Mr. J. Donald, of Wigton, the first recognised breeder of them in England, in referring to the same points, viz., the head and bill, says—" The head of the drake is a bronzy-green, and that of the duck a faint fawn. The bill of the drake is a yellowish-green, while the bill of the duck is a dark cucumber shade."

While Lewis Wright, the great English writer and authority, says, in referring to the head and bill—" The bill is yellow, when hatched, gradually becoming green, the drakes being more of a yellowish shade than the duck. The head has a dark cap."

The standard of the Poultry Club of England, which is also the standard of New South Wales, says—" The head should have a cap, but it omits to say what colour, which is evidently wrong, and as regards the bill the standard says yellow when young, gradually changing to green in the adult bird." Now in all the views from these leading authorities there is undoubtedly a divergence of opinion as regards the colour of the head of both the drake and the duck, and also in regard to the colour of the bill, and the standard which should settle the whole question is the most vague of all the descriptions. In the coloured plate in Lewis Wright's latest work, it will be seen that the artist, Mr. Ludlow, has given the head of both drake and duck in the picture the same colour for cheek and cap as the fawn body colour of the duck, while each of the quoted authorities, Wright, Donald, and Cadell, are unanimous in stating it should be of a different colour, although they diverge on the actual colour, Mr. Cadell saying black, Mr. Donald saying bronzy-green, and Wright saying dark. Again, in the coloured plate Mr. Ludlow has put the opposite colour beaks on each bird, while Mr. Wright says the drake has a rather more yellowish shade than the duck. Mr. Ludlow has reversed this in his picture, as any one can see who refers to it, by putting the greenest bill on the drake and the yellowest on the duck. But both Cadell and Donald differ from Wright in the colour of the bill of the duck. While Wright says it should be greenish-yellow, both Cadell

and Donald agree, Cadell saying it should be a dark green, and Donald saying it should be a dark cucumber shade, which is a dark green. Personally we have seen all of these colours. We have seen drakes with fawn heads, and drakes with black or bronzy-black heads, and we have seen drakes with cucumber-coloured bills (light and dark) and also the ducks. We have treated very fully of this subject, as it is a very important one, and one which will have to be discussed and settled some day either here or in England, and as we have never seen the fact alluded to, we have taken the trouble to point it out very fully so that everyone can understand it, as there is no doubt it will cause the Indian Runner breeders to discuss the matter, and perhaps elucidate some points which have been to many of the breeders of the Indian Runners up till now a mystery.

From a utility point of view it will pay well to farm Indian Runners for egg-production; duck eggs sell well in our market, and to have a few hundred Indian Runner ducks laying in April, May, and June, with eggs at 2s. per dozen, would mean a very profitable industry, and this can be very easily attained, in fact they can be successfully bred all the year round, and they will then lay all the year round.

A lot of people are under the impression that to start a duck-farm they would require lakes or ponds for them to swim in, but such is not the case, artificial ponds only create labour for no gain. A large Indian Runner duck-yard could be started, and thousands of ducks farmed, bred, and reared without one single pond, and many of these farms could be profitably carried on in many of our coastal district flats, where fowl-farming would not be successful owing to dampness. General farmers on our coastal belt could make a very remunerative section of Indian Runners by farming these ducks largely for eggs, and feeding them off their own lands by growing maize and lucerne only, both of which crops can be successfully grown in any part of our coastal flats.

Ducks can be fed successfully on a ration composed of half crushed maize and half chaffed lucerne. If meat can be obtained readily and cheaply it will pay to purchase supplies, but, even if unobtainable, ducks can be successfully farmed on good grass land, with plenty of run, without even seeing a scrap of meat. The classes for Indian Runners at our leading shows are now being well filled, and as this duck is gaining rapidly in favour every day, the competition will be getting keener, and the classes will contain even a larger number of entries than they do to-day, consequently the question which we have so prominently brought forward, and so fully discussed as regards the colour of the cap in the drake, and even the colour of the whole head, requires to be settled, and also a finality of the colour required in the bill for both the drake and the duck arrived at.

Here we give the standard for judging Indian Runners from the Poultry Club's standards, drawn up in England and accepted here by the Poultry Club of New South Wales, and which is the standard that all our judges are expected to go by in handling the class—Indian Runners.

Indian Runner Ducks.

General characteristics in both sexes :—

Head and neck.—Head, fine and comparatively flat. Bill, strong at the base, broad and long, coming as nearly as possible straight down from the skull, giving it the appearance of a long wedge. Eye, situated high up in the head. Neck, as long and thin as possible from the base.

Body, long and narrow, without any indication of keel. Breast, round and full. Back, long and narrow. Wings, carried close and firm.

Tail.—Slightly elevated, with two or three well curled feathers in the tail of the drake.

Legs and feet—Set well back, causing the erect carriage. Toes, straight and connected by web.

General shape and carriage.—Racy looking; the body carried erect, somewhat after the form of the Penguin.

Size and weight.—Drake, 4½ lb.; duck, 4 lb.

Colour in Indian Runner ducks in both sexes :—

Head—The head should be adorned with a cap, and cheek markings of fawn or grey, to match body colour as nearly as possible; a narrow line of white divides the cap from the cheek marks, whilst a line of white about ⅛ of an inch should divide the base of the bill from the head markings.

Bill.—Yellow when young, gradually changing to green in the adult bird, with a black bean at the tip.

Neck.—Pure white from the head to where the breast markings begin, about 1½ to 2 inches from the base of the neck.

Back.—Fawn or grey.

Wings.—The shoulders and top part of wings fawn or grey, the flights white.

Breast.—Fawn or grey, evenly cut about half-way between the point of the breast-bone and the legs.

Fluff.—White, except an indistinct line of colour from the base of the tail to the thighs.

Tail.—Fawn or grey.

Legs and toes.—Deep bright yellow.

The colour of an Indian Runner, whether fawn or grey, should be uniform throughout the whole of the surface-plumage, except the tail of the drake, which is darker. The fawn or grey of the shoulders, top part of wings and tail should be the shape of a heart pressed flat on the back.

Value of points in Indian Runner ducks.

Defects.	Deduct up to Points.
Defects in head, eyes, and bill	15
,, head markings	10
,, neck and neck markings	10
,, body	10
,, body markings	25
,, legs	5
Want of type, symmetry, and condition	25

Serious defects for which a bird should be passed :—

Claret breasts; blue wing bars; horizontal carriage; absence of flight feathers, or any other part of the body; twisted wings; wry tail; or any other deformity.

(*To be continued.*)

Hawkesbury Agricultural College.

MONTHLY WEATHER REPORT.

Summary for May, 1905.

Air pressure (Barometer).			Shade Temperature.				Air Moisture Saturation = 100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 13 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for 7 years.	% of the year's Evaporation.
29·27 29th.	30·50 20th.	30·06	36·8 12th.	79 5 8th.	56·8	56·5	54 9th & 31st.	100 1st & 4th.	84	0·161 9th.	1·952	2·216	4·5

Rainfall																			
Dates	1	2	3	4	5	6	8	19	20	21	22	23	24	25	26	28	29	Total,	Mean rainfall for 13 years.
Points	3	37	21	198	2½	4½	8	11	16	10	5	2	2½	3	6	6	1½	3·37 in.	217 points.

Wind ...	N	NE	E	SE	S	SW	W	NW
	3	18	2	2	2	2	3	2

Thunderstorms on dates—27th, 28th.

Greatest daily range of temperature, 34·1°—8th May.
Extremes of rainfall—0·229 in., 1894; 5·226 in., 1898.
Days on which shade temperature fell below 40° at night.—12th, 14th, 15th, 16th, 28th, 29th.
Frosts occurred on dates—12th, 15th.

Remarks.—A damp month with frequent fogs. Weather mild and open; no heavy frosts to do any damage. Barometer very low during 29th and 30th.

CHAS. T. MUSSON.

Special Notice as to the "Sparrow" Circular.

Wanted Replies from the following Places.

To complete our Sparrow Map, giving a survey of the districts inhabited by the House Sparrow, we still require reports positive or negative from the undermentioned places.

Interested persons are invited to send in replies in order that the preparation of a full report may be proceeded with at once.

Angledool.	Condobolin.	Menindie.	Tabulan.
Araluen.	Coonabarabran.	Mittagong.	Tenterfield.
Barraba.	Cootamundra.	Moama.	Ulladulla.
Boggabilla.	Denman.	Molong.	Walgett.
Bombala.	Drake.	Moruya.	Wellington.
Bowral.	Eden.	Murrurundi.	Warren.
Burren.	Euston.	Narrandera.	Wee Waa.
Brewarrina.	Germanton.	Narromine.	Wickham.
Byrock.	Gundagai.	Nelligen.	Wilcannia.
Carrathool.	Gundaroo.	Nerrigundah.	Wingham.
Cassilis.	Hargrave.	Nimitybelle.	Western Districts.
Collarendabri.	Kiandra.	Stroud.	

Reply to Principal, Hawkesbury Agricultural College, Richmond.

Australian Horse Trade.

THE Government of India, through the Director-General of Remounts, takes from two to three thousand horses annually for army purposes (last year four thousand), at £45 per head, landed and approved in India. The horses brought over for this purpose are nearly all unbroken.

These horses are mainly horse and field artillery class, with more or less cavalry from time to time. These artillery classes are the pick of the horses of that type bred in Australia, and, unfortunately, the class is decreasing rapidly.

I would not have bothered you with this subject were the matter not entering into an acute stage, but horses of the class required are now so scarce that they realise prices at which our shippers will not be able to continue the trade, and I have this season had to import horses for army purposes from North America, Argentina, and Hungary, in order to see how these horses do in India, and thus be able to turn elsewhere at once for remounts should Australia fail us. It would be a matter of the deepest regret should I have to do so, for, as we stand, I believe that no other army in the world is horsed as well as His Majesty's Army in India is with our Australian horses, and I sincerely trust that the supply may continue. I have talked the matter over with Mr. Campbell, Director of Agriculture for New South Wales, and with the Hon. Mr. Swinbourne, Minister for Agriculture in Victoria, and they both agree that some step should be taken immediately to mend matters. I trust, however, that the subject may receive your assistance, for whatever is done should be done quickly or the trade will be lost to Australia.

As regards the decrease of the class of horse we require, this is in no way owing to the purchases of horses made for South Africa, Germany, and Japan, as these horses were of a very different standard; so much so that when the War Office proposed, when returning British cavalry regiments to India (sent from India to South Africa ready horsed) to send them with the horses on which during the process of time they had been remounted in South Africa, this offer was, on my representation as to the inferior class of horse we should receive, refused by the Indian Government.

In addition to the Government trade, large numbers of superior horses are annually shipped from Australia for the private market in India.

The difficulty now experienced in obtaining the class of horse we require for the army in India is, I believe (and I have made very careful inquiry into the matter), mainly due to the facts—

(1) That many inferior stallions are being used.

(2) That owners have sold many of their best mares for export.

The remedy, if I may be allowed to offer an opinion, is—

(1) A tax on all stallions, none being allowed to cover unless passed by a duly qualified official appointed to inspect them.

(2) In Government providing really good stallions—thoroughbreds, Clydesdales, Suffolks, and Welsh ponies—for use by breeders at a nominal fee. This system obtains in all the great horse-breeding countries in Europe (I personally have had the advantage of visiting these countries for the Government of India, and studying the systems in force); or

(3) In giving premiums to private individuals (as is done on a very small scale in England), who will stand approved stallions at a nominal fee for the use of breeders.

(4) Steps should be taken to prevent the best mares leaving the country.

With regard to (2) and (3), it may be thought that (2) might interfere with private enterprise; should this be so, then (3) would meet the case, should sufficient private owners be willing to take the matter up, on the local Government calling for offers to do so; but I would strongly urge that whatever is done be done without delay. It must also be remembered that in either case the whole success of the matter depends on thoroughly suitable men being chosen to approve or buy stallions; and stallion keepers should have sufficient experience to advise small breeders, who own two or three mares, which class of stallion to put to their mares.

Australia has a record second to no country in the world for breeding good horses of every class, and the trade with India in such horses brings a certain amount of money into the country (mainly to Victoria, New South Wales, and Queensland), for remounts alone this season £180,000 (£45 x 4,000) having been paid by my Department for Australian horses. In addition to this, it must be remembered that a large amount of money, labour, &c., is employed for forage, grain, shipping, &c., for the large number of horses now exported from Australia, and it would be a million pities that this should go elsewhere.

(Sgd.) HOWARD GOAD, Colonel,
Director-General, Army Remount Department, India.

8th April, 1905.

Weeds of New South Wales.

A Blue Weed (*Verbena venosa*, Gill. *et* Hook.).

J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

Botanical Name.—*Verbena*, Latin for the herb Vervain (a Verbena), an equivalent also for all sacred leaves, such as laurel, olive, myrtle, rosemary, &c., used to adorn altars in Roman times. Paxton, however, says it is said to be derived from its Celtic name "Ferfaen." *Venosa* (Latin), full of veins, referring to the under side of the leaves.

Botanical Description.—*Genus*—Verbena, Tournef :—

Calyx.—Five-toothed.
Corolla.—With five spreading slightly unequal lobes.
Stamens.—Usually four, enclosed in the corolla tube.
Ovulary.—Four-celled.
Fruit.—Dry, separating into four nuts.
Herbs or rarely shrubs with opposite leaves
Flowers.—Usually in terminal bracteate spikes.

Species.—*Venosa*, Gill. *et* Hook.—A perennial herb with a simple erect quadrangular stem, about 1 to 1½ feet high, the whole plant rough, with short harsh hairs.

Leaves.—Opposite, oblong-lanceolate, acutely and remotely dentate, sessile, with a broad subcordate base, strongly veined underneath (the character from which the specific name "venosa" has been derived).
Flowers.—Blue-purple, in short spikes, terminal, and on rather long peduncles in the axils of the uppermost bracts and floral-leaves.
Corolla.—Three times longer than the cylindrical calyx, and twice longer than the bracts; the tube hispid.
Calyx.—Splitting when the enclosed fruit is ripe. (Description taken from New South Wales specimens, with the help of Dr. Gillies and Hooker's original description in Hooker's *Botanical Miscellany*, Vol. 1, p. 167 (1830).

It is only likely to be confused in New South Wales with *Verbena bonariensis*, a taller and much more widely diffused plant.

Vernacular Names.—People in New South Wales most commonly call it "Blue Weed," a name it shares with other *Verbenas*, with *Echium*, and other plants. The colour of the flowers is, however, of a rich purple. "Wild Verbena" or "Vervain" are also applied to it.

Fodder or other uses.—I cannot find any use to which this plant is put. It is harsh, and stock always reject it. It possesses no poisonous properties. It is a very pretty plant, and hence leniency has been shown to it, but it should be pulled up wherever it makes its appearance in a fresh place.

Where found.—It is a native of the Argentine, South America, but it has now spread to most sub-tropical regions of the world. In New South Wales, though not the commonest Verbena by any means, it is widely diffused in the coastal districts, and is spreading westerly. It frequents grass land, and commonly invades a district through the sides of its roads. It was doubtless originally brought to this State as a garden plant.

EXPLANATION OF PLATE.

Whole plant.
- A Part of inflorescence.
- B Whole flower, with bract.
- C Corolla opened, showing stamens and pistil.
- D Calyx with bract.
- E Pistil.

ORCHARD NOTES.

W. J. ALLEN.

JULY.

THE principal work for this month will be the pruning in all deciduous orchards, while in citrus orchards and passion vineyards there will be the picking, packing, and marketing of fruit.

Pruning.—This most important work should not be neglected, whether the grower has one tree or a hundred-acre orchard, as it is only by giving the tree every care that we can hope to make it yield profitable crops from year to year. Pruning, of course, is only one branch of the work in connection with the care of the orchard. If only this branch of the work were executed, and the cultivation, manuring, &c., neglected, we could not expect, in many districts, to harvest crops of fruit annually; but given the necessary care, and we do expect to be well repaid for the expenditure of time and labour incurred in attending to the many wants of the trees.

As this is the season for pruning, let us see to it that at least this part of the work is well done, giving to each kind and variety of fruit the pruning found best suited to it, as no hard and fast rule can be laid down for all trees and vines. It is only by studying the habits of the different trees and vines, and profiting by the experience gained from year to year that we can hope to prune in such a way as will give the best results; for instance, the fruit on an apple-tree may be too large to suit the market, or it may be too small. In the former case, it would be well to give the tree more fruiting wood in order to increase the quantity of fruit which the tree will have to carry. By so doing it will be found that the fruit will be smaller, while, in the latter case, it would be advisable to leave less fruiting wood, and if the tree still sets too much fruit, resort to thinning, so that it will not carry more than it can mature properly.

Then there are varieties such as the Cleopatra, which, if not pruned so as to keep the tree well opened out in order to admit light and air to its centre and along the branches, will be found, in many places, to develop bitter pit

A BLUE WEED (VERVAIN OR WILD VERBENA).
VERBENA VENOSA GILL ET HOOK.

so badly as to make them practically valueless. Again, the Perfection, which is a very upright grower, must be kept well opened out in the centre in order to give it any spread at all.

In connection with the pruning of grape vines, the Sultana requires long spurs, as the bud or two next to the old wood seldom produce any grapes; while the Gordo Blanco, on the other hand, is best pruned back to short spurs, as all buds on same are found productive, and if too many are left it is usually found that only those furthest away from the old wood develop properly and produce fruit and strong canes. It is then found hard to prune properly the following year, as the best wood, in place of being close to the old wood on the crown of the vine, is some few inches further away than is desirable. The latter vine should always be pruned so as to form a compact, and not a spreading head.

If too much wood be left on trees, the crop will, in all probability, make such a drain on the tree that not only will the fruit be small and badly flavoured, but the tree will be so weakened as to unfit it for producing a crop the following year.

Let each fruit-grower, therefore, study the habits of the different trees, and prune them in such wise as will cause them to return him the best fruit from year to year; and under no circumstances allow any tree to be started with long trunks and the limbs bare of fruiting wood, which only exposes them to the sun's rays, and, in all probability, will result in their being burnt and stunted and so weakened as to be of little commercial value.

During the last few weeks it has been my experience to visit an orchard which had been practically ruined by an incompetent pruner, and the owner thought it more economical to uproot a large percentage of the trees and plant anew rather than try to bring the older trees back into a profitable condition.

During the last two years I have explained through the columns of this *Gazette* how to prune the different trees; and the reader, when in doubt as to the pruning of any of his trees, may, on referring to same, get the information he requires; but on no account neglect the work, and see that it is completed in good time so that the usual winter spraying of the trees may follow on before the buds burst in the spring.

In packing and handling citrus fruits, see that they are not bruised, else they will not keep. The fruit should be well graded and neatly packed, so that it may present a good appearance when offered for sale, as badly graded and packed fruit does not sell so well as that which has been properly prepared.

All refills should be planted without further delay. Where new orchards are to be planted, the sooner they are in now the better, as the roots start growing this month, and the better hold they get of the ground in the early part of the season the stronger growth they will make during the summer.

While pruning or working around the trees, always keep a sharp look-out for any diseases which are liable to attack them; and should any be found, mark the trees affected, so that at the right time they may be given a proper dressing.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

DIRECTIONS FOR THE MONTH OF JULY.

Vegetables.

AT time of writing these notes, the middle of June, the season is favourable, in a remarkable degree, for the growth of many good vegetables, and there is every reason to think that this will continue, although it is probable that during July some severe cold weather may set in and continue all through the month of August. If any part of the vegetable garden happens to be unoccupied by vegetables it had better be manured and dug up, in order that with very little work it may be quickly cropped when required.

Although very cold weather may set in, it will not be too cold to stop the growth of weeds of some kind or other, therefore it will be necessary to look well after seedling vegetables or they may be smothered and spoiled. After rain, and as soon as practicable, the soil between vegetables should be broken up with hand hoe of some kind.

Asparagus may be planted next month, but it would be just as well to prepare some land for it in good time. This land had better be manured; if poor apply heavily; but if in good heart little manure may be required. The most suitable manure for this and all vegetables is good rotten dung of farm animals, excluding that of the pig, which, however, can be used, if rotted, with excellent effect on the flower garden.

Globe Artichoke.—This may a'so be planted next month. The soil should be made rich if not naturally so.

Artichoke, Jerusalem.—This is a very useful vegetable, and in all well-kept vegetable gardens there should be any amount of the tubers ready for use during July. Planting may be carried out now or during the month of August, whenever most convenient. Plant in well-manured land, 4 or 5 inches deep, in rows 3 to 4 feet apart, or even wider apart would be better still. Set the artichokes about 1 foot apart in the rows.

Beans, Broad.—A few rows may be sown, but it is rather late for them, except in cold districts.

Beans, Kidney.—In the very warmest districts near the sea where there are no frosts, or where frosts are very light indeed, seeds may be sown towards the end of the month.

Mr. Selkirk, of Killara, an excellent amateur gardener, who in his spare time raises the vegetables he requires for use, brought me to-day, 14th June, some fine specimens of a climbing bean known as "Tongan." He considers it a very fine variety indeed and a most prolific one, producing beans well into

the winter. The ripe seed is small and dark brown, and the pods are rather peculiar in appearance, being roundish, of a light-green colour. This bean, if it can be procured, should be tried by those who grow vegetables for their own use. I cannot say whether this would be useful for market purposes.

Broccoli.—Sow a pinch of seed from time to time, and if any young sturdy plants are ready, put out a few occasionally. Use abundance of good manure.

Cabbage.—Sow a little seed, and plant out occasionally during the month. Summer varieties of those kinds which are likely to withstand a fair amount of dry weather should be tried. Of these, the old St. John's Day is a good and reliable one. There is a small early variety of St. John's Day well worth a trial.

Carrot.—Sow a little seed occasionally. Thin out well soon after they come up, and keep the plants well weeded.

Cauliflower.—Raise a few plants in the cool districts for planting out as soon as they are large enough.

Cucumber.—Sow a few seeds in warm sheltered part of the garden under a frame of some kind, preferably glass, and plant the young cucumbers when they are sufficiently advanced and hardy, but after planting protect at nights with bagging, straw, dried grass, or something to protect them from the cold. These coverings should be removed early in the mornings.

Leek.—Sow a little seed, and plant out leeks already raised if large enough. The land for the leeks should be heavily manured.

Lettuce.—Plant out any suitable seedlings on hand, and sow a little seed in order to have a sufficiency of plants for requirements.

Onion.—Seedlings raised for transplanting should be ready for planting during the month. This method of growing onions is about the best that can be adopted by those persons who raise vegetables for their own use. If the roots are long, trim them back to an inch or so of the little bulb, cutting back the tops slightly. Water well after planting and they will get along satisfactorily. Sow a little seed if necessary.

Parsnip.—Sow a little seed once or twice during the month.

Peas.—Be certain to raise a good supply of peas, for they are always in demand for use in the house. Mr. Ellis, of the Howlong Viticultural Station, who tries a good many kinds of vegetables for me in his spare time, sent me lately some of the very best peas I ever tasted. These were two varieties new to the State and named Prince of Wales and Prince of Peace. If anyone who reads this can obtain seed of these two peas I advise them to do so. I also obtained from him some skinless peas named Gourmand, which came originally from Switzerland and were given to me. This is a delicious variety, and well worth anyone's while to grow. Another variety, a French one, named Petit Pois, probably the same as Pois Nain Vert Petit. This is a very prolific pea, well filled pods, but not so good as the two first mentioned.

Spinach.—Sow a little seed in drills about 2 feet apart. Thin out the seedlings well as soon as they are large enough. Try some of the New

Zealand spinach, an excellent vegetable which grows wild about some of the sandy beaches on the coast. It has become a weed in many places in the country quite in the inland districts, and has probably escaped from some Chinese garden. I have seen it frequently in out-of-the-way places in the vicinity of such gardens growing in great luxuriance.

Tomato.—Mr. Selkirk, before mentioned, brought me recently some fine specimens of a tomato named Federation, the seed of which was given to me by Mr. Krempin, of Newcastle. This is a prolific and capital tomato, highly appreciated by Mr. Selkirk, who considers it invaluable for a late crop, for the fruit is ripening well now—the middle of June. The fruit is pear-shaped and large for this type. It seems to be disease-proof, for Mr. Selkirk found it to be untouched, whilst other varieties were badly affected this season. Tomato seed may be sown under protection in order to raise early plants.

Herbs.—Sow seed of various kinds, including parsley.

Flowers.

This is about the most dull portion of the year for flowers, generally speaking, although many beautiful kinds of bulbs may come into flower. There is the winter flowering species of Iris stylosa, which is an exceedingly pretty thing when in full bloom.

Of the Narcissus section of bulbs some varieties are likely to produce an abundance of flowers during the month. Snowflakes and probably early freezias are likely to flower well, and anemones and ranunculuses should be flowering profusely.

Roses and deciduous plants, including climbers, may be planted, but if the weather turns out to be warm and moist and the season early, the sooner the planting is finished the better, for when little thread-like white roots appear, growing from the old roots, any shifting of the plants may result in loss, unless more than ordinary care be taken.

Wet Rot in Potatoes.

Mr. J. G. Keegan, writing from Lue, 1st May, 1905, says :—"In reading the very interesting article in February Gazette *re* 'Wet Rot in Potatoes,' I desire to state that I met with the disease first twelve years ago, at Kembla, near Wollongong. A friend there drew my attention to the fact that some members of his family were very ill, and attributed same to eating new potatoes. He had dug here and there some stalks that seemed to ripen earlier than others, having fair sized eatable tubers on. I dug some specimens, sending haulms, tubers, and soil to the Department of Agriculture. The report was, 'Wet rot.' All the symptoms as described in the above-mentioned article were present. The ground was new, sandy soil, with fern growth previously. I published the Department's reply in the *Illawarra Mercury*, for the public good."

Farm Notes.

Hawkesbury District—July.

H. W. POTTS.

THE past month has been one of special activity. Every opportunity has been seized to take full advantage of the splendid weather and mild temperatures to push on with sowing operations on all sections. This autumn may be recognised as one of the most favourable for growth. In addition to the crops which are all well forward, we have the inevitable growth of weeds. They have responded tô the suitable weather conditions, and hence necessitates increased attention for their suppression and turning under. July and August are usually our severest months. In defining and laying out operations we are guided to a large extend by the condition of the soil and the climate. All point to phenomenal growth, and a good spring.

Our staple crop is maize, and the preparation of the land must occupy some attention. Whilst some land is poor for the growth of this cereal, it is equally true that maize growing on low-grade land does not pay; but it does not permit us to assume that such land cannot be brought into a fertile condition by cultivation, the growth and ploughing-in of leguminous crops, and the application of manures. We have to aim at a maximum growth of stalk, and a prolific ear. The crop will limit its growth to the fertility of the soil, its physical state, and the climate. With persistent and intelligent effort large areas of land can be brought into a condition favourable for profitable maize-growing, and many exhausted corn-growing areas can be rejuvenated and restored to normal fertility. One of our most disastrous forms of soil exhaustion is soil washing, especially in our loose sandy loams. A greater part of the accumulated soluble plant food is washed out by heavy downpours of rain where the land is uneven, badly cultivated, and containing little humus to absorb the rain. The conditions favour the plant food of lighter portions of soil being washed off or out of the soil.

Our chief concern is to render the soil absorbent, to make it act as a sponge or reservoir, to retain, take up, or absorb all rainfall, to encourage it to penetrate the soil. The subsoil should be loose and porous to aid in this important function, and the texture made retentive by the constant addition of humus or decomposing vegetable matter.

The nature of our operations to attain this desirable state depends largely on the subsoil. Some are compact, stiff, and impermeable, others are the reverse. Some loose, readily soaked, and drained subsoils are liable to prove as easily washed as surface soils. In such case the growth of green crops, when turned in, acts as a check, and further increases soil fertility as well as

improves the physical texture or condition. The retention of soil moisture is a leading factor in the success of the maize crops. It is at this period when the soil is occupied with green growths, either as weeds, or catch crops, we have to consider a proper system of cultivation. The inturning of green manures or green growths of any kind during the winter months is good preparation for the following season's maize crop. Moreover, the subsoiling, or rather stirring of the soil at depths of from 8 to 12 inches, increases its moisture storage capacity.

This portion of the work must be considered now, and taken in hand. Where large quantities of farm-yard manure are available then soil lacking in plant-food may be enriched, failing which, the continued growth and ploughing-in of such crops as peas, tares, lucerne, clover, lupins, &c., will be found the cheapest means of enriching the soil, particularly with nitrogen.

Wheat.—The completion of sowing the wheat crops may be effected this month. The early crops will require attention owing to the very mild autumn and their rapid growth. Should they be forced into ear towards the latter part of July it will be good practice to feed off or cut the crop, harrow in a top-dressing of 1 cwt. super-phosphate to the acre, and stimulate a heavy second growth.

Barley.—Sowings of English and Cape barley may be made for grain. The skinless variety may also be sown for a continuation of hay supplies.

Oats.—Sowings of oats should also be continued.

Rape and Mustard.—Both these crops can be provided this month to furnish suitable fodders which are quickly grown and occupy the soil profitably.

Onions.—The young plants may be set out in rows in suitably prepared beds and in well-sheltered localities.

Field Peas and Tares.—Both crops can be sown separately or with oats or barley. The combination balances the green ration, and tends to keep down the bran bill during the early spring months. Sufficient attention has not been paid to this form of cultivation in our dairying centres.

Emerald Rye affords a good hay crop on poor sandy soil, and the forage returns repay the farmer well under adverse conditions.

Rape.—Those who have adopted the principle of growing catch crops will find a marked benefit from rape. The growth this season has been rapid and heavy. The feeding value of this fodder plant, and its chemical composition, resembles clover. In flesh-forming constituents it is richer, and, in addition, it is very relishable and succulent. Its water contents will run from 83 to 92 per cent. The nutritive ratio, or proportion of flesh-forming food material to the carbo-hydrates, or heat and energy constituents, is about 1 to 3·37. This closely approximates the nutritive ratio of lucerne and clover. With rape the rich feeding value is due to the high proportion of protein or nitrogenous material it contains. Growing animals require a balanced ration providing a nutritive ratio of about 1 to 5·5, and necessarily when rape is fed it is essential to include some other food not so rich in protein, such as mixed pasture, hay, or chaff.

Rape is especially useful in fattening old ewes. It constitutes good feed for putting young ewes in suitable condition for breeding. Lambs always do well upon it, particularly when it is associated with other food.

It makes excellent forage for brood sows fed with a few maize cobs or a small daily ration of barley.

For young growing pigs, or for fattening them, it is possibly one of the best grazing fodders. There is sometimes a little difficulty at first in persuading the animals to eat it, but once the taste is acquired for this change of food there is no trouble. One acre of well-grown rape has been known to fatten thirty-five to forty pigs in four months. This, however, depends on the soil, climate, and character of the crop. Good results are obtained when the animals are hurdled on $\frac{1}{4}$ acre at a time. The most profitable returns are made when the crop is cut and fed to the pigs in the styes.

Calves take to rape at a very early age, and do well on it, provided some caution be exercised in commencing to feed in a small way and at a stage when they are taking to eating pasture.

Young cattle relish this forage, and steers being got ready for market put on flesh rapidly.

Dairy cows will do well on it, but judgment must be exercised to avoid tainting the milk. See that it is fed after milking is over.

Care at all times should be taken to prevent bloating or hoven. Never permit any animals, excepting pigs, to enter a paddock of rape when hungry. Let them become gradually accustomed to the new ration, and then they may be given full liberty.

Rape must be eaten as it reaches maturity. Owing to its succulent nature it cannot be cured, and it is not a profitable crop to be turned into ensilage. It is most serviceable when fed green. Rape is a gross feeder, and unless grazed or suitable manuring effected to restore fertility, it will leave the soil in a somewhat impoverished condition. There are several advantages in using it as a catch crop. It only occupies the ground about nine or ten weeks. Owing to its deep root system it acts as a subsoiler, and also brings up from the sterile subsoils stores of potash and phosphoric acid to the surface. The thick succulent foliage affords excellent fodder for grazing sheep and other animals. They return to the soil a valuable fertiliser in the form of dung and thus prepare the soil for subsequent crops of cereals, whilst the farmer has mutton and wool or pork as a gain for the catch crop.

Stock of all kind will require special care, particularly in the direction of shelter and stall-feeding. Young cattle and stores should be well fed, seeing the grass is beginning to go off. Those who are fortunate enough to have a paddock of lucerne will find it best to utilise the green crop for feed instead of converting it into hay during adverse weather. A full development of bone, muscle, and red flesh is encouraged by this class of fodder.

The sheep should be kept as much as possible out of wet paddocks, and given sweet hay, oaten straw, rape, or turnips.

The pigs are fortunate in having an ample supply of paspalum grass, cocksfoot, sheep's Burnet, prairie, clover, lucerne, potatoes, artichokes, barley, rape, sweedes, turnips, kohl rabi, sweet potatoes, and pumpkins.

The opportunity might be taken to devote some attention to improving the general appearance and attractiveness of the homestead by planting out shade, ornamental, and shelter trees such as the Queensland silky oak, the kurrajong, pepper, pines, maples, planes, oaks, blue and sugar gums, cedars, camphor laurels, &c.

The growth of hedges may also be taken in hand to provide shade and shelter for young stock. The broad and narrow-leaved Japanese Privets, African Box Thorn, Pines, and Hawthorns are all useful. Mr. Maiden has already provided excellent directions for the preparation of the ground and planting in recent issues of the *Gazette.*

Riverina Notes—July.

G. M. McKEOWN.

Barley may still be sown for green fodder only. The skinless variety being early will be found the best for the purpose.

Lucerne.—Land should be got ready for sowing, which may be carried out from this time till about the middle of September.

An advantage to be gained in sowing at this season in preference to the autumn is that the barley-grass, and other weeds will have made a good start, and they can be checked for the season by ploughing under, thus giving the lucerne a better start. It is very undesirable to sow lucerne where it will have weeds or other crops to compete with it.

Where possible subsoiling will improve its chances of success, and where subsoil ploughs are not available, a good substitute may be made by removing the mould-board from an ordinary single-furrow plough, and following with it in the bottom of the furrow made by the implement which is used to turn the surface furrow. By this means land may be deeply worked without bringing sour subsoil to the surface.

This method, however, will apply only to small areas, as the work can only be done slowly.

For performing the double operation with one team the Secretary disc subsoil plough will be found a good implement.

Where the crop is sown for hay use 12 to 15 lb. of seed per acre if sown broadcast; 5 to 8 lb. being sufficient for pasture.

When intended for pasture it will be found advisable to cut the first two growths so as to allow the plants to become fairly established before stocking.

When the grazing of established pastures is practised it should be so regulated as not to admit of the crowns of the plants being eaten out.

Low-lying situations should be selected, as they usually afford a greater depth of soil, and in such positions a better supply of moisture is available.

Sheep's Burnet.—In free soils, in portions of this district, excellent pasturage is obtainable from this plant which holds its own well with the grasses which remain in land which is cultivated. It responds readily to showers and, with a fair amount of moisture, affords a green bite when little else is available.

The land should be well worked and brought into fine condition, and the seed should, if possible, be sown with the drill. About 10 to 12 lb. of seed per acre will be sufficient for sowing with an ordinary wheat drill with attachments for small seeds.

The crop may be lightly stocked when well grown, but at the time of first feeding off the sheep should not be allowed to remain long enough to injure the crowns of the young plants.

When properly established it will stand fairly heavy stocking if paddocks are used in rotation.

TRIALS of Varieties of Oats.—Areas, ¼ acre to 1 acre each.

Date sown.	Variety.	Yield per acre.			
		bus.	lb.		
May 3 ..	Algerian	71	38		Rust-proof and drought-resistant. The two best varieties for this district.
	Red Rust-proof ..	61	27		
	Welcome	28	16		Straw weak, slight rust.
	American Banner ..	36	26		Straw fair, slight rust.
	Peerless Bonanza ...	37	5		Straw very weak, crop badly laid, rust slight.
	Wideawake	31	25		Straw fair, rust slight.
	Great Northern ...	45	22		Early variety: straw and grain of excellent quality.
	Big Four	46	0		Straw weak, rusty.
	Twentieth Century ...	38	31		Straw fair, rusty.
	Silver Mine	43	3		Straw weak, rust slight.
	Carter's Royal Cluster	39	55		Coarse weak straw, slightly rusty.
	White Tartarian ...	30	10		Quality good, clean strong straw.
	Clydesdale	39	13		Straw weak and light.
	Danish Island ...	43	3		Vigorous and clean, quality good.
	Skinless	27	9		Fairly rust free, but liable to smut.
	Cut for Hay—	t.	c.	q.	
May 3 ..	Golden Giant ...	2	2	2	Damaged by caterpillars.
	Dun	2	16	0	A rust-proof variety; quality excellent.
		bus.	lb.		
June 1 & 2	Great Northern ...	28	14		Straw and grain of excellent quality.
	White of Ligomo ...	33	36		Straw strong and erect, slightly rusty.
	Colossal	36	9		Early. A good stooler. Straw and grain of good quality; clean.
	Tartar King	19	31		Straw coarse and erect, slight rust.
	Storm King	16	6		
	Goldfinder	20	2		A fair stooler, straw erect and of fair quality.
	Abundance	26	13		Stooled fairly, straw erect and of medium thickness; clean.

GLEN INNES DISTRICT.—JULY.

R. H. GENNYS.

JULY is late for sowing wheat for grain, still, if the land and seed are ready it may be sown with some hopes of a good crop, should the season prove favourable. Choose sorts the most rust-resistant, perhaps excepting the Manitobas, which, although they resist rust, are not likely to fill well if planted too late. Sow grain more thickly as the season progresses. For hay it is a good time to sow, and the Manitobas make capital hay. Sow more thickly for hay than for grain.

Barley and *Rye* may still be sown: but if for grain, get in as quickly as possible.

Oats may be sown both for grain and hay.

Land in which it is intended to grow spring crops may be turned over. Keep sods as much on end as possible, and leave the ground rough in order that the air may get at it as much as possible while fallow.

Vegetables.—Cabbage, cauliflower, lettuce, spinach, onions may be sown.

BATHURST DISTRICT—JULY.

R. W. PEACOCK.

Farm Calendar.

January.—Sow Maize and Millets, also small sowings of Wheat, Barley, and Rye, for green fodder, Swede Turnips; Potatoes for late crop early in the month.

February.—Sow Rye, Barley, and Wheat, for green fodder, Swede Turnips, Main crop of Rape towards end of month, Thousand-headed Kale, Lucerne, Black Tares, Carrots.

March.—Sow Rape, Kale, White Mustard, Swedes, Carrots, Lucerne, Clovers, Black Tares, Field Peas, Grasses, Sheep's Burnet; Barley, Rye, and Wheat to be fed off by stock.

April.—Sow Wheats for main crop, Oats, Barleys, Ryes, Lucerne, Rape, Kale, Clovers, Black Tares, Field Peas, Grasses, Linseed, Sheep's Burnet, White Mustard.

May.—Sow Wheats, Oats, Ryes, Barleys, Lucerne, Clovers, Black Tares, Field Peas, Sheep's Burnet, Linseed, White Mustard, English Grasses.

June.—Sow Oats, Ryes, Field and other Peas, Black Tares, Onions.

July.—Sow Oats, Ryes, Peas, Black Tares, Onions.

August.—Sow Oats, Rye, Peas, Tares, Onions.

September.—Plant Potatoes about middle of month for early crop. Sow Maize about end of month upon the highlands. Mangels, Beet, Carrots, Jerusalem Artichokes, Lucerne, Clovers, Grasses, Sheep's Burnet, Tobacco.

October.—Sow Maize, Millets, Sorghums, Cowpeas, Potatoes, Mangels, Beet, Carrots, Jerusalem Artichokes, Pumpkins, Melons, Sunflowers, Buckwheat, Tobacco, Native Grasses.

November.—Sow Maize, Sorghums, Millets, Cowpeas, Pumpkins, Melons, Potatoes, Sunflowers, Buckwheat, Native Grasses.

December.—Plant Potatoes for main late crop. Sow Maize and Sorghums for green fodder; Hungarian and other Millets for Hay; Pumpkins at beginning of month.

Vegetable Garden Calendar.

January.—Sow main crop of French Beans, Butter Beans, Swede Turnips. Make small sowings of Cucumbers, Custard Squash, Marrows, Radish, Parsley, Cress, Onions, Sweet Corn, Lettuce not to be transplanted. Sow in seed beds Cabbage, Cauliflower, Brussels Sprouts, Broccoli, Leeks, Parsley. Transplant Cabbage, Cauliflower, and Celery.

February.—Sow for main crop Swede Turnips, White Turnips. Make small sowings of Parsnips, Peas, Broad Beans, Beet, Mustard, Cress, Radish, Lettuce not to be transplanted. Sow in seed beds Broccoli, Savoy Cabbage, Leeks, Celery, Brussels Sprouts. Transplant Cabbage, Cauliflower, Leeks, Celery, and Eschalots.

March.—Sow for main crop Savoy Cabbage, Onions, Broad Beans. Make small sowings of Peas, Beet, Carrots, Parsnips, Mustard, Cress. Sow in seed beds Onions. Broccoli, Leeks Transplant Savoy Cabbage, Broccoli, Onions, Leeks, Eschalots.

April.—Sow for main crop Broad Beans, Onions. Make small sowings of Spinach, Peas, Lettuce, Radish. Sow in seed beds Onions, Savoy Cabbage, Herbs. Transplant Savoy Cabbage, Broccoli, Eschalots, Tree Onions, Potato Onions, Garlic.

May.—Sow for main crop Peas. Broad Beans. Make small sowings of Onions, Lettuce. Beet. Sow in seed beds Herbs, Cabbage, Onions. Transplant Savoy Cabbage, Tree Onions. Potato Onions. Onions, Eschalots, Winter Rhubarb, Horse Radish.

June.—Sow for main crop Peas, Broad Beans. Make small sowings Lettuce, Radish, Spinach. Sow in seed beds Cabbage, Cauliflower. Transplant Cabbage, Cauliflower, Herbs, Rhubarb, Tree Onions, Potato Onions, Garlic, Eschalots.

July.—Sow for main crop Peas, Broad Beans. Make small sowings of Lettuce, Radish. Sow in seed beds Cabbage, Cauliflower. Transplant Cabbage, Cauliflower, Herbs, Rhubarb, Eschalots, Asparagus.

August.—Sow for main crop Peas. Make small sowings of Carrots, Parsnips, Beet, Lettuce, Broad Beans, Radish. Sow in seed beds Cabbage, Brussels Sprouts, Tomatoes, Chillies, Cape Gooseberry, Egg Plant. Transplant Cabbage, Cauliflower, Lettuce, Rhubarb, Asparagus, Eschalots.

September.—Sow for main crop Parsnips, Carrots, Beet, Cabbage. Make small sowings of French Beans, Potatoes, Cucumbers, Melons, Squashes, Pumpkin, Sweet Corn, Jerusalem Artichokes, Peas, Broad Beans, Mustard, Cress, Radish. Sow in seed beds Cabbage, Lettuce. Transplant Cabbage, Lettuce, Tomatoes, Chillies, Cape Gooseberry, Egg Plants.

October.—Sow for main crop Early Potatoes, Carrots, Parsnips, Melons, Pumpkins, Squashs, French Beans, Butter Beans, Lima Beans, White Turnips, Jerusalem Artichokes, Sweet Corn. Make small sowings of Peas. Sow in seed beds Kohl Rabi, Cabbage, Lettuce. Transplant Cabbage, Lettuce, Tomatoes, Chillies, Egg Plants, Cape Gooseberries, Brussels Sprouts.

November.—Sow for main crop Parsnips, Carrots, Melons, Pumpkins, Cucumbers, Squashs, Sweet Corn, Potatoes, Beet, French, Lima, and Butter Beans. Make small Sowings of Tomatoes, Peas, Cucumbers. Sow in seed beds Cabbage, Brussels Sprouts, Lettuce. Transplant Cabbage, Lettuce, Kohl Rabi, Brussels Sprouts, Tomatoes.

December.—Sow for main crop Late Potatoes, French and Butter Beans. Make small sowings of Cabbage, Parsnips, Turnips, Lettuce, Radish, Beet, Squashs, Marrows, Cucumbers, Sweet Corn. Sow in seed beds Cauliflower for main crop, Cabbage, Kohl Rabi, Brussels Sprouts, Celery. Transplant Cabbage.

NOTE.—Frosts commence April, end about October.

RICHMOND RIVER DISTRICT—JULY.

C. H. GORMAN.

Wollongbar Farm.

A NUMBER of northern river farmers are turning their attention to the cultivation of Rhodes grass, which so far has passed the experimental stage with satisfactory results, inasmuch as it is shown to be well adapted to our climatic and other conditions, and is well liked by stock. All that now remains to be shown is that it will last and stand feeding. Many grasses give most satisfactory results up to the point of grazing, and after that fail to realise what is expected of the particular variety. As far as Rhodes grass is concerned, there are indications that it will stand all that we want of it, but until such time as I have had sufficient experience in the directions indicated I prefer not to express an opinion. At the same time I recommend all interested to give it a thorough trial. Roots for trial are available for free distribution to those who care to have them. Up to the present, over 3,500 roots have been sent away, while many have taken a root or two which has not been accounted for, and which will actually bring our distribution up to nearly 5,000. Although much has appeared about this promising grass, no analysis of its feeding value has been published. I therefore append at foot an analysis by Mr. F. B. Guthrie, Chemist to the Department of Agriculture:—

Moisture	15·09	per cent.
Ash	·50	,,
Fibre	28·79	,,
Albumenoids	9·62	,,
Carbohydrates	44·98	,,
Ether extract (fat or oil)	1·02	,,
	100·00	
Nutritive value	56·8	
Albumenoid ratio	1 to 4·9	

IT may interest those who study the question of grasses to compare the above analysis with that of another of our valuable varieties, viz., Guinea grass. As a grass for hay, chaff, or green feed, it is very hard to beat for this part, provided it can be sown above the reach of frosts. It gives an immense quantity of green fodder, and it is well relished by stock. A very large number of roots have been distributed to farmers, and the reports from them are very satisfactory. The analysis is as under:—

Moisture	12·14	per cent.
Fat (ether extract)	1·10	,,
Albumenoids	6·70	,,
Woody fibre	34·52	,,
Ash	8·15	,,
Carbohydrates (by difference)	37·39	,,
	100·00	
Containing nitrogen	1·07	per cent.
Albumenoid ratio	1 to 6	

THERE is a point concerning both the grasses that should be remembered—that they both make excellent hay, quite as good as our most valued pasture grass, *Paspalum dilatatum*, and in the case of the Rhodes grass, it will be easier to make than the latter. No one seems to seriously think of making hay in any quantity, and seeing that our district is such a wonderful one for the growth of grass, it is a wonder that more grass hay is not made and put on the market. I feel sure that it would be profitable, because in the majority of cases the grass that is not turned into hay is allowed to waste. Even though the sale may not bring in a large profit, it will be a considerable advantage to the paddocks to have the heavy coating removed at the right time.

THOSE who have expressed opinions favourable to the Guernsey breed of cattle crossed with other breeds will be pleased to hear of the results given up to the present. It must be remembered that the young cows are on their first calf, and it is reasonable to expect that at later periods the results should be very much better. They are all by the imported Guernsey bull Peter, a sire who in this part has proved himself to be one, if not the best of the sires imported by the Department of Agriculture. There are also some very fine grades in the district by the imported bulls Rose Prince and Nutcracker, but none show up so well as those by Peter. At this farm there is a young bull and two heifers by Peter that give great promise. The following are the yields to date:—

Bud, grade Guernsey, calved 23rd June, 1904; milking 281 days for 6,396 lb. milk; average test, 6·02 per cent.; representing 351·711 lb. commercial butter to date, 31st March, 1905.

Sapphire, calved 30th August, 1904; milking 213 days for 4,512 lb. milk; average test, 4·87 per cent.; representing 230·271 lb. commercial butter to date, 31st March, 1905.

Honeysuckle, Durham x Guernsey, calved 23rd November, 1904; milking 128 days for 2,804 lb. milk; average test, 4·47 per cent.; representing 134·751 lb. commercial butter to date, 31st March, 1905.

Violet, grade Guernsey, calved 27th December, 1904; milking 90 days for 1,485 lb. milk; average test, 4·52 per cent.; representing 74·30 lb. commercial butter to date, 31st March, 1905.

Pebble, calved 29th December, 1904; milking 93 days for 1,733 lb. milk; average test, 4·57 per cent.; representing 85·20 lb. commercial butter to date, 31st March, 1905.

Doreen, Durham x Guernsey, calved 4th January, 1905; milking 86 days for 2,191 lb. milk; average test, 3·75 per cent.; representing 96·86 lb. commercial butter to date, 31st March, 1905.

Dulcie, grade Guernsey, calved 3rd February, 1905; milking 54 days for 1,456 lb. milk; average test, 3·35 per cent.; representing 60·35 lb. commercial butter to date, 31st March, 1905.

THE following are some yields of the progeny of the imported Shorthorn bull Cornish Boy from grade cows:—

Tulip, grade Shorthorn, calved 10th July, 1904; milking 364 days for 5,961 lb. milk; average test, 4·52 per cent.; representing 254·78 lb. commercial butter to date, 31st March, 1905.

Plush, grade Shorthorn, calved 17th July, 1904; milking 257 days for 4,887 lb. milk; average test, 4·50 per cent.; representing 210·18 lb. commercial butter to date, 31st March, 1905.

Queen, grade Shorthorn, calved 15th August, 1904; milking 228 days for 6,744 lb. milk; average test, 4·02 per cent.; representing 286·13 lb. commercial butter to date, 31st March, 1905.

CHEESE-MAKING is in full swing at the farm, and much interest is being shown in the instruction given by Mr. Hayward, Dairy Instructor. Surprise has been expressed at the good article being turned out, as it was considered next to impossible that cheese could be made of good quality in this district. It might be advisable for young farmers to turn their attention to the manufacture of cheese, and as the farm is in the district for the benefit of the farmers, visitors will be welcome and information given in this direction whenever requested.

FOR the information of district farmers, the following bulls are available for stud purposes, but owing to the big demand for the services of the Guernsey bulls, it will be necessary, when bulls of that breed are to be used, that arrangements be made beforehand:—

Guernseys.—Prince Vivid, by Rose Prince (imp.) ex Vivid.
Peter's Lad, by Peter (imp.) ex Souvenir.
Ayrshire.—Prince Royal, by Curley Prince ex Rosie 5th.
Holstein.—Hollander, by Bosch (imp.) ex Margaretha.

A Shorthorn bull will soon be available for service, in place of the young bull Royal Duke 2nd, the latter having been sent to another district for service.

PIGS of the following breed are kept, and the hogs are available for service at a fee of 5s., viz., Tamworth, Berkshire, Poland China, Large Black. Young pigs are also available for sale, and all information will be furnished when required.

MENTION might also be made of the fact that farmers or their sons will be made welcome at lectures and demonstrations. All that is necessary is to make application to the Manager for particulars, &c.

CLARENCE RIVER DISTRICT—JULY.

T. WALDEN HANMER.

THE weather during the past few weeks has been rather warm for the season, accompanied with foggy and slight frosty mornings. This has been very beneficial for killing weeds, thus enabling ploughing to be proceeded with, but the crops for green feed have, in many places, been retarded for want of rain.

Although a little late, wheat may still be sown for hay, care being taken to sow only reputed rust-resisting varieties.

Land should be prepared for Spring sowings of barley (Cape or Skinless, the latter being preferable), oats, Hungarian millet, field-peas, and rape.

For lucerne, land should be deeply ploughed and brought to a fine tilth, and about 15 lb. seed planted to the acre. Every farm, small or large, should have its patch of lucerne, and, for ordinary farm purposes, that known as the "Broad-leaf" is by far the most suitable.

Potatoes may be planted in well-drained land, and the following seem to be the most marketable varieties:—Bliss's Triumph, Brunnell's Beauty, Early Rose, Circular Head. On the Grafton Farm we have found the Early Ash-leaf, Kidney, and Magnum Bonum yield very well, but some people appear to dislike white potatoes.

Tomato and cucumber seeds may be sown, but, of course, must be protected from frosts.

Sowings may also be made of broad beans, French beans, peas, cauliflower, cabbage, beet, lettuce, endive, parsnips, carrots, radishes, &c.

Fruit trees may still be planted, and pruning should be completed this month.

Any farm lands lying fallow will always be much improved by cropping with leguminous plants, such as tares, cowpea, rape, to be ploughed in as green manures.

Rabbit Destruction.

G. M. McKEOWN.

As enquiries are often made for information on the subject of rabbit destruction by means of fumigation with carbon bi-sulphide, it is considered desirable to again publish the information obtained by tests at the Wagga Experimental Farm.

From July, 1903, to 7th September, 1904, the cost of material was £1 19s. 6d.; labour, £3 15s.; or a total of £5 14s. 6d., the area treated being 1,500 acres. The operator will require an assistant, but the cost of labour shown above should be sufficient at ordinary rates of pay on farms, &c. During the first two years the cost of labour each year was about double that of last year. The great reduction in the cost of labour and material is, I consider, due to the systematic destruction of the burrows in the earlier period, and to the fact that after practice and careful observation of the effects of the application of the carbon bi-sulphide the operator has found it possible to obtain the desired result with a less quantity. Our practice has been to dig out all burrows of moderate size, and to fumigate the large burrows or warrens. The rabbits on adjacent lands do not appear to take kindly to our paddocks for a long time after a course of fumigation and burrow-destruction has been carried out. It has been necessary, therefore, to use the poison cart only once during the past fourteen months, although there are over 2,000 acres not netted.

The following is the method of applying the carbon bi-sulphide :—

Reduce as far as possible the number of entrances, including the "peep-holes," connected with the burrow to be operated on. For this purpose a few shovelfuls of earth will generally be found sufficient.

Take a piece of cotton waste, forming a ball about an inch and a half in diameter, and saturate it quickly with the liquid and throw it as far as possible into the open burrow.

It should be promptly followed by a lighted wax match, which will rarely fail to cause an explosion, which will instantly fill the burrow with the poisonous fumes.

All burrow openings should be promptly closed with earth. Although the fumes are probably quite as deadly without the application of fire, it is considered that they travel more rapidly after ignition and the smoke enables vents to be more easily detected.

Great caution should be exercised in handling the liquid under all conditions, as it is highly volatile and explosive. The drum containing the bulk supply should be buried at a safe distance from buildings, stacks, &c., and the necessary supply for the day should be carried in glass-stoppered bottles. No lighted pipe or fire of any description should be allowed near the material, and cool weather should be chosen for the work. The operator at the burrows should be the only person allowed to ignite the material when it has been placed in position, and the stopper should be replaced in the bottle before the match is lit.

The treatment has always proved most effective, as we have never yet found a treated burrow to have been opened from the inside.

Burrows opened up for test purposes within three minutes after treatment have disclosed numbers of dead rabbits, but never a living one, and rabbits taken from treated tree trunks in which there have been vents have expired within a few seconds.

The price of the material is about 5d. to 6d. per lb. in Sydney, and 5d. in Melbourne. Our last purchase was 60 lb., which cost with freight £1 12s. The cost of cotton waste was 7s. 6d., but some of the latter is still on hand.

Crown Lands of New South Wales.

THE following areas will be available for selection on and after the dates mentioned:—

FOR HOMESTEAD SELECTION.

H.S. or S.L. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
			a. r. p.		a. r. p.		£ s. d.	1905.
971	Nyngan ..	....	....	1	425 0 0	Nyngan, 2½..	6 12 10	29 June

FOR SETTLEMENT LEASE.

H.S. or S.L. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
			a. r. p.		a. r. p.		£ s. d.	1905.
797	Coonamble..	....	....	1	2,094 1 0	Gilgandra, 10; Dubbo, 35 to 40.	11 4 6	22 June
799	do ..	Wingadee ..	8,570 0 0	2	3,710 0 0 and 4,860 0 0	Coonamble, 50; Walgett, 20.	65 14 0 and 91 2 6	22 „
798	Walgett ..	....	....	1	6,247 0 0	Walgett, 30..	104 2 4	13 July

FOR IMPROVEMENT LEASE.

CENTRAL DIVISION.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
			a. r. p.		a. r. p.		£ s. d.	1905.
1338	Coonamble..	Tenandra & Tonderburine.	....	1	5,000 0 0	Gulargambone, 16; Gular, 18.	83 6 8	Sale, 17 July
1341	Parkes ..	Middlefield	....	1	1,755 0 0	Dandaloo, 14; Trangie, 42; Narromine, 44.	18 6 7 Inclusive of use of Crown improvements.	„ 17 „
1343	Warren ..	Mumblebone.	....	1	2,500 0 0	Warren, 24 to 27 ..	20 16 8	„ 17 „

For Conditional Purchase.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		a. r. p.			£ s. d.	1905.
Armidale	Enmore .. .	52 3 0	Enmore	Sandon ..	1 0 0	27 July.
" ..	Long Flat	44 0 0	George	Clarke ..	2 0 0	10 Aug.
" ..	Torryburn	71 0 0	Yarrowick	Hardinge ..	1 0 0	24 "
Bellingen* ..	....	300 0 0	Coff	Fitzroy ..	1 0 0	24 "
Cassilis	....	1,310 0 0	Lorimer	Bligh ..	1 0 0	10 "
Grafton* ..	....	290 0 0	Bards'ey	Fitzroy ..	1 0 0	24 "
Hay	South Thononga ..	2,840 0 0	Belgura and Eurugabah	Nicholson ..	1 0 0	3 "
Molong	....	350 0 0	Narragal	Gordon .	1 10 0	24 "
Mudgee	....	330 0 0	Tannabutta . ..	Wellington ..	1 0 0	3 "
" ..	....	1,100 0 0	Broombee and Tunnabutta.	" ..	1 5 0	3 "
Narrabri ..	Therribri ..	1,260 & 3,300	Therribri, Leard, Rusden, Bejar, Ballyena.	Nandewar	1 0 0	27 July
		6,700 0 0			1 5 0	
		2,700 & 3,365			1 10 0	
		2,520 0 0			1 11 8	
		262 1 0			1 12 6	
Port Macquarie*	....	640 0 0	Burrawan .. .	Macquarie .	1 0 0	17 Aug.
Rylstone ..	....	340 0 0	Glen Alice . ..	Hunter ..	1 0 0	17 "
Tamworth and Murrurundi.	Wombramurra (partly)	5,000 0 0	Crawney, Wombramurra and Lincoln	Parry and Brisbane	1 0 0	3 "
Taree	....	900 & 1,450	Gooloongolok ..	Gloucester .	1 0 0	27 July.
Tenterfield ..	Deepwater.. ..	660 0 0	Romney .. .	Clive.. ..	1 5 0	27 "
" ..	....	315 0 0	"	" ..	1 5 0	17 Aug.
" .	....	5,000 0 0	" . .	" .	1 0 0	17 "
Urana	Coree	572 0 0	Coree North .	Urana .	1 6 8	27 July.
Wagga Wagga	....	200 0 0	Book Book . .	Wynyard .	1 3 4	27 "
Walgett	....	5,350 0 0	Sussex and Ireelmon	Leichhardt .	1 6 8	13 "

* Available for "originals" only.

Conditional Purchase as Special Area.

Cowra Land District, 154 acres 3 roods, in parish Kenilworth, county Bathurst; maximum area, 51¾ acres; minimum area, 51¼ acres; price, £3 per acre. Available for original conditional purchase only on 13th July, 1905.

Lismore Land District, 149 acres 1 rood 25 perches, in parish Bexhill, county Rous; price, £4 per acre. Available for original conditional purchase only on 3rd August, 1905.

Warren Land District, 99 acres 3 roods 32 perches, in parish Garule, county Oxley; maximum and minimum area, 99 acres 3 roods 32 perches; price, £3 per acre; distant ½ to 1 mile from Nevertire. Available for originals only on 29th June, 1905.

Windsor Land District, 45 acres 1 rood 20 perches, in parish of Pitt Town, county Cumberland; maximum and minimum areas, 45 acres 1 rood 20 perches; price, £3 per acre. Available 29th June, 1905.

Young Land District, 10 acres 1 rood 20 perches, in parish Young, county Monteagle; maximum and minimum areas, 10 acres 1 rood 20 perches; price, £3 per acre. Available, 29th June, 1905.

(Signed) EDWARD MACFARLANE,

Under Secretary for Lands.

AGRICULTURAL SOCIETIES' SHOWS.

1905.

Society.	Secretary.	Date.
Hay P. and A. Association (Hay)	G. S. Camden	July 27, 28
Riverina P. and A. Society (Jerilderie)	Wm. Elliott	,, 25, 26
Moama A. and P. Association	C. L. Blair	Aug. 9
Corowa P., A., and H. Association	F. L. Archer	,, 15, 16
Parkes P., A., and H. Association	G. W. Seaborne	,, 16, 17
Murrumbidgee P. and A. Association (Wagga Wagga)	A. F. D. White	,, 23, 24
Forbes P., A., and H. Association	N. A. Read	,, 9, 10
Gunnedah P., A., and H. Association	J. H. King	,, 22, 23, 24
Grenfell P., A., and H. Association	Geo. Cousins	,, 24, 25
Young P. and A. Association	Geo. S. Whiteman	Sept. 6, 7
Albury Annual Show	Walter J. Johnson	,, 12, 13, 14
Manildra P. and H.	E. J. Allen	,, 13
Wyalong District P., A., H., and I. Association	S. G. Isaacs	,, 5, 6
Northern Agricultural Association (Singleton)	C. Poppenhagen	,, 13, 14, 15
Corowa P., A., and H. Association	F. P. Fawcett	,, 20, 21
Germanton P., A., and H. Society	Jas. S. Stewart	,, 20, 21

1906.

Albion Park A., H., and I. Society	Henry Tryer	Jan. 17, 18
Tamworth Agricultural Association	J. R. Wood	Mar. 27, 28, 29
Tenterfield Intercolonial P., A., and Mining Association	F. W. Hoskin	,, 6, 7, 8
Fair days	....	,, 9, 10
Hunter River A. and H. Association (West Maitland)	C. J. H. King	April 24, 25, 26, 27, 28

[1 plate.]

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Agricultural Gazette of New South Wales.

Dairying in New South Wales.

What the Agricultural Department is doing for the Dairy Farmers.

M. A. O'CALLAGHAN.

In order that farmers may fully understand the nature and amount of help which the Department of Agriculture is prepared to give them, it is deemed advisable to clearly set forth these services.

1. Improvement of Dairy Herds.

The Department through its officers gives advice on all matters relating to cattle, and, in addition, keeps a number of stud bulls (all from imported stock) for lease to dairy farmers at a nominal rate. Young bulls are also sold at very reasonable prices. The following breeds are represented under these lease and sale conditions :—Shorthorn (dairy strain), Holstein, Red-poll, Guernsey, Jersey, Ayrshire, Kerry, and Dexter Kerry. Applications for the lease of bulls are so numerous that applicants should apply some months before they require the animals' services.

In addition, the services of special stud bulls are available at the State farms at Berry, Wollongbar, Hawkesbury College, Grafton, and Bathurst, at 10s. per cow.

2. Instruction in Cattle Breeding and Management.

Pupils may obtain special instruction on these heads at Wollongbar Dairy Institute, at Berry Stud Farm, and at the Hawkesbury Agricultural College.

At Berry out-door pupils only are taken, but accommodation may be had very close to the farm.

3. Testing Milk and Cream.

In order to enable farmers to know the quality of the milk yielded by their cattle, samples may be forwarded, and a fat analysis of same will be given free of charge.

The testing of cream is becoming a big item in the laboratory of the Dairy Branch. At present considerable dissatisfaction exists among farmers regarding the system of paying them for their cream, and, with a view to checking factory results, the farmers send their cream for analysis. Then they calculate their butter results from the "cream chart and guide" published by the Department. This double check, viz., the test and the cream chart, enables the farmer to keep a check on the churn results from the factory, whether proprietary or co-operative. Farmers sending samples of milk or cream should fill the bottles (a 4-oz. bottle) completely up to the cork to prevent churning, and should post samples direct to The Dairy Laboratory, 140, George-street North, Sydney.

4. Instruction in Butter and Cheese-making.

Full instruction in the manufacture of butter and cheese and general dairy work may be obtained by pupils attending the special courses at the Hawkesbury Agricultural College and Wollongbar Dairy Institute, near Lismore. Intending factory managers may also be trained at the Hawkesbury College. The terms are £12 10s. for six months indoor instruction.

5. Itinerary Instruction in the Care and Management of Milk and Cream.

Factories may obtain at any time the services of a competent instructor in the grading of cream. This instructor grades the cream at the factory. He then visits the homes of the farmers supplying inferior cream, with the object of discovering the cause, and instructing the farmer in the best methods of handling milk and cream. This system of home instruction has been productive of much good.

6. Home Instruction in Cheese-making.

The Department has secured the services of an able instructor in cheese-making from New Zealand. He has already met with much success, having visited the factories and homes of our principal farmers engaged in cheese-making. His services are at the disposal of farmers and factories engaging in this profitable branch of the industry free of charge.

7. Aid and Advice in the Erection of Factories.

Wherever a body of farmers purpose erecting a dairy factory (butter or cheese), the Department will, if requested, send an expert to confer with the promoters, help to select site, &c., and give plans and a list of suitable machinery.

8. Examination of Butter, Cheese, Cream, Milk, and Water, with a View to Detecting the Cause of Taints, &c.

Bacteriological examinations of dairy products are made free of charge for factory managers and farmers. Such examinations of butters for export have proved highly useful and instructive. Samples of liquid should be sent in sterilised bottles, addressed direct to the Dairy Laboratory. Butter and cheese samples should be carefully put up in the cleanest wrapping and not allowed to remain about uncovered for any time after sampling.

9. Instruction in Testing.

Whenever a body of farmers arrange for a number of people (say at least ten) who wish to learn how to test milk and cream, an instructor will attend free of charge. Such classes can be held at a central farmhouse or School of Arts.

10. Lectures.

Wherever a body of farmers desire a lecture on dairy matters, an officer of the Dairy Branch will attend, if requested, and supply all information relating to the dairy industry.

An Illawarra Shorthorn on her first calf, now stationed at Grafton State Farm. She yielded over four gallons per day for a long time after calving.

Hind-quarter of a Cow that gave 5 gallons of milk per day on her first calf. One of the milkers at the Grafton Farm.

DAIRY CATTLE AT THE GRAFTON STATE FARM.

Cheddar Cheese-making: Canadian System.

Complete Details of Manufacture.

W. GRAHAM.

In writing this article I have endeavoured to make it as simple and explicit as possible for the benefit of the student or beginner, rather than the older and more experienced cheesemaker.

The first and very important thing is the treatment of milk when drawn from the cow, it is necessary that the milk should be cooled and aërated—the night's milk especially,—as it having to be kept until the morning everything should be done to have it in a nice sweet condition. It is necessary to adopt the following precautions:—

See that your milking utensils and everything the milk comes into contact with are washed properly in boiling water.

Aërate and cool in a cool and sweet atmosphere, away from the smell of the milking-yard, manure heap, fowl-yard, etc. Always try to cool the night's milk down to 68 deg. F.

Always keep your dairy inside and outside as clean as possible, and never forget the fact that it is human food you are manufacturing. The reasons for these precautions are: when milk is aërated in a foul atmosphere or comes in contact with dirty utensils, organisms get into the milk which cause bad flavour in the cheese, and also cause gassy and floating curds. In cooling the night's milk you are checking the growth of lactic acid, as it is the lactic germ that causes the milk to become sour, and as they multiply very quickly when the milk is of high temperature, hence the advantage of cooling the night's milk down to a low temperature. It should be stirred at intervals whilst cooling and the last thing before retiring at night, to prevent the cream from rising, for when the cream is allowed to rise and form a crust on top of the milk, it will not mix readily with the milk again,—thus a good deal of the butter-fat floats away in the whey. When it has been stirred while cooling and at intervals afterwards, the cream readily mixes with the milk and consequently no loss takes place.

The night's milk and morning's milk are mixed together in the vat, and the temperature raised to 86 deg. F. to find out the ripeness of the milk. To see whether it is ready to add the rennet, we have two tests, the rennet test and the alkali test,—either of these are fairly reliable if carefully taken. In taking the rennet test you are not testing the strength of the rennet, but finding out how fast the lactic acid is developing in the milk. Take 4 oz. of milk in a cup or glass, be sure the temperature is 86 deg. F., place a float in the milk, a piece of straw or a chip of wood, add one dram of rennet,

and stir with a spoon for five seconds, then withdraw the spoon from the cup altogether, and note how many seconds the milk takes to coagulate,—when the straw ceases to twirl in the cup the milk has become thick. Take the number of seconds from when the rennet is added until the straw stops twirling. Now, for example, say we set at 20 seconds with the rennet test, and we found that the curd was slow in working (laid a long time before the whey was ready to draw), next day we would allow the milk to ripen a little more before setting,—that is, reduce the seconds on the rennet test from 20 to, say, 16; or on the other hand, if the curd worked too fast, set sooner, say 22 seconds. Thus it is the rennet test that is a guide to the cheesemaker and regulates the work through the day, inasmuch as he knows by careful manipulation of his test—he can set his milk at the proper time, which will enable him to have a good firm shotty curd when the whey is ready to draw off.

If making a coloured cheese, add the colouring before adding the rennet, in the quantity of a quarter of an oz. to an oz. to 1,000 lb. of milk, according to the shade of colour required. In setting the milk the quantity of rennet depends upon the strength of the rennet: sufficient rennet should be added to coagulate the milk to have it firm enough to cut in from thirty to forty-five minutes. The quantity as a rule is from 3½ to 4 oz to 1,000 lb. of milk; dilute the rennet in a little clean cold water, and stir into the milk; the stirring should continue from three to four minutes to ensure it being properly mixed; the stirring should then cease and the milk allowed to set. If the cream shows a tendency to rise to the top, the surface could be agitated with the hand or a light piece of wood, but the moment coagulation shows signs of taking place, this should cease. After about thirty minutes has elapsed the curd should be tried to see if it is ready to cut. A good way to do this is to wet the finger and dip into the curd in a slanting direction, then on lifting it up if the curd breaks readily and clean off the finger it is sufficiently firm to cut with the curd-knife; avoid cutting too soon when the curd is soft; it should be allowed to remain a little longer until it becomes firm. If the knives are used before the curd is sufficiently firm a good deal of waste takes place, because the curd being in a soft condition gets broken up, resulting in the fine particles of curd floating away in the whey. Use the horizontal knife first longitudinally or up and down the vat, do not hurry the operation, and be careful not to break the curd by pushing it in front of the knife, once with the horizontal knife is sufficient. Then use the perpendicular knife across the vat, and then up and down the vat. When the operation is complete the curd is cut into cubes of about three-eighths of an inch in diameter. If the milk should be working fast necessitating the hurrying of the cooking of the curd, it will be found an advantage to cut the curd finer; a second application of the perpendicular knife will be found to be an advantage. After the curd has been cut with the curd-knives, begin stirring with the hands; go round the sides of the vat and the bottom and remove any curd that may be adhering; do not allow it to settle to the bottom or form in the corners; the stirring should be continued until the curd is finished cooking. After stirring with the hands for a little while at

first, the agitator or rake could then be used. The stirring should be gentle at first to allow the cubes time to firm a little. Then, as the cooking process proceeds, the stirring could be more vigorous; never allow the curd to run together in lumps, thus to ensure an even cook right through the whole of the vat's contents. To handle the curd by stirring roughly in the first stages of cooking, when the curd is soft and tender, the loss will be considerable. Thus by careful cutting and careful stirring the loss is very small; the colour of the whey will be more or less clear, not showing the white milky colour, as is the case when through rough handling a good deal of waste has taken place. The object of cutting the curds into cubes is that it expels the whey freely and allows these particles to become firm and properly cooked. In cooking the curd gradually raise the temperature from 86 deg. to 98 deg., 2 deg. in the first ten minutes and 2 deg. in every five minutes afterwards, thus the time taken from when the heat is first applied until it is raised to the proper cooking temperature should be thirty-five minutes. The object of cooking is the expulsion of whey from the curd, thus causing it to become firm and shotty. It is not advisable to raise the temperature too quickly, as a skin forms on the outside of the cubes and the moisture is retained within, thus a gradual heating process is necessary, causing the whey to be expelled and the curd to become firm at the same time. If you find when you have raised the temperature to 98 deg. F. that the curd is not firming up as well as you would like it to do, raise the temperature a couple of degrees higher (say), 100° or 102°, but never on any occasion is it advisable to raise it higher than 104 deg. F., as the risk of having a corky cheese is great, and a big percentage of the butter fat is melted and lost in the whey. The time for wheying off should be from two and a half to three hours after the rennet has been added, not sooner than two and a half hours if possible, and not later than three hours. To have sufficient acid to draw the whey off before two and a half hours the chances are that your curd is too soft, and when the cheese has been matured they will show a pastiness when rubbed between the fingers, showing insufficient cooking, and will go off in flavour very quickly. If, on the other hand, the curd remains in the whey over three hours, the curd becomes too hard, and has a tendency to make a tough leathery cheese. The amount of acid at wheying off should be from $\frac{1}{8}$ to $\frac{1}{4}$ of an inch by the hot-iron test.

The Hot Iron Test.

Take a round iron bar about 18 inches or 2 feet long and about a quarter of an inch thick and heat in the fire. Take a handful of curd the size of a walnut and squeeze together until all the whey or nearly all the whey is pressed out of it. Then take the hot iron in one hand, the curd in the other, rest the hot iron against the wall, and place the curd which you hold in your other hand against it. Do not have the iron too hot, but just hot enough to brown the curd. Then draw the curd gently and slowly away from the iron, and if fine silky threads from $\frac{1}{8}$ to $\frac{1}{4}$ of an inch can be obtained the whey is ready to draw off. Draw the whey off through the gate or tap in the vat or by means of a syphon. Lose no time in getting it off; be as quick as possible,

because this is a critical point at this stage of the manufacture, and too much acid given at this particular time will result in a dry, mealy, bleached, sour cheese. So the cheesemaker has to be alert. Drain the whey off as quickly as possible, and throw the curd on to wooden racks placed in the bottom of the vat and hand stir until the curd becomes fairly dry, then throw it together to give it an opportunity to mat or form into a solid mass. The vat should be covered with a clean cloth or canvas covering to keep the temperature even. It is essential that the temperature should be kept at about 90 or 92 deg. so that the production of lactic acid is not checked. If the temperature is allowed to fall the development of acid is checked, and the curd takes a much longer time to form into a flaky substance. Fifteen minutes after the curd has been thrown together, it should be cut into square or oblong blocks about 18 inches by 6 inches and turned over, and allowed to remain for another period of ten or fifteen minutes. Then if the curd is firm the blocks could be piled two deep; but if the curd is soft, they should be left single and turned over. The object of this process is to eject the whey from the masses of curd. The process of turning every ten minutes should be continued, never allowing the whey to form in pools between the blocks else the colour is likely to become bleached or mottled in places. In the course of about two hours from the time the whey was drawn, the blocks of curd will have assumed a smooth soft velvety feeling, and when tried on the hot iron will draw fine threads about 2 inches long. The object of matting the curd is to improve the texture. The casein in the curd during the matting process breaks down and becomes to a certain extent soluble, and cheese made from a well-cooked curd that has been properly matted, when they are marketable, will always show a nice waxy texture so different to the soft pastiness that is always found in a badly cooked and improperly Cheddared cheese. The curd should now be milled and spread over the bottom of the vat. The object of milling is to cut up the curd so that the salt will be evenly distributed through the curd. Unfortunately there are a large number of mills which cut the curd too small. The pieces of curd should be, after passing through the mill, about ½ an inch in diameter. When the curd is cut too fine, too much moisture is drained from the curd when the salt is added and the texture of the cheese is completely spoiled. After milling, the curd should be turned over gently at intervals of about three minutes, and should not be allowed to mat. This is called airing the curd, the object being to allow any gas which may have accumulated to escape, and should be continued until the curd assumes a soft, silky, velvety feeling. The flavour of the curd can be very much improved at this stage by airing longer, and the curd will develop that peculiar nutty flavour so characteristic in a good cheese. The salt should now be added, the amount is generally from 2¼ to 3½ lb. per 1,000 lb. of milk. Of course, the quantity varies according to the richness of the milk. Where the milk is poor the percentage of curd is less, necessitating the use of less salt. When the milk is rich the percentage of curd is greater, thus requiring more salt. It is therefore necessary to adopt a sliding scale during the season. Starting in the spring of the year when the milk is poor in butter

fat with $2\frac{1}{4}$ lb. of salt and gradually increasing the quantity as the season advances and the milk becomes richer. Of course there are occasions when a little extra salt will be an advantage. For instance, when the curd is soft and moist a little extra salt will assist in draining away a good deal of the extra moisture; or if the flavour is not good, a little extra salt will assist in retarding the effects of the bad flavour as the cheese ripens. The salt should be sprinkled over the curd and mixed thoroughly. Then three or four minutes should elapse, to allow the salt to dissolve, before putting to press. It will be found that the temperature will have fallen considerably from the time of wheying off until the period of salting. From 78 deg. to 82 deg. F. is about the proper temperature to press the curd at. Higher than 82 deg. the fat is readily pressed out and lost. Lower than 78 deg the particles of curd will not adhere in a solid mass. When the temperature is too low—below 78 deg.—the lactic acid has been checked, and it is essential in obtaining a close-bodied cheese to have the proper amount of acid when the curd is put to press. When that is not present, the cheese is loose and full of holes; when cut or bored with the trier they show ragged openness right through. It is impossible to press a cheese close if the temperature has fallen too low and the amount of acid insufficient. When the bandage is put on the hoops the ends should be turned in about 2 inches at the bottom of the hoop and a cap put in to cover the whole of the bottom of the hoop. The unstarched seamless bandage is preferable to any other, as it is difficult to get a proper rind on the cheese with the starched bandage; it should also be the proper width so that no wrinkles or laps will show on the finished cheese. The same amount of curd should be placed in each hoop so that each cheese will be of the same size, showing uniformity. When putting the cheese to press the pressure should be put on slowly at first and gradually increased. The cheese should remain for an hour, then they should be taken out of the press, the bandage pulled over the ends, the cheese turned and put back in the press. There they should remain with a good steady and continuous pressure on for at least twenty hours. When taken out after the twenty hours have elapsed, they should be wiped dry with a cloth and placed in the cheese-room. The cheese should be turned on the shelves every day so that the rind dries evenly. The temperature should not exceed 65 deg. F.

The Alkali Test.

The necessaries for the alkali test consist of a c.c. burette with graduated scale, each division or c.c. on the scale representing ·1, and each smaller division between representing ·01 and a pipette for taking the measure of liquid to be tested. The burette is filled to the O.c.c. mark with a solution of caustic soda or standard alkali. A measure of whey or milk to be tested is taken. Three drops of indicator or phenol phthalein are added to the liquid (whey or milk), then the alkali in the burette is dropped into the sample of milk or whey and stirred until the liquid turns pink. Then by reading on the scale of the burette the amount of alkali it has taken to turn the liquid pink is the percentage of lactic acid in the sample of milk or whey.

A solution of decinormal strength, each c.c. on the graduated burette, equals ·009 grammes of lactic acid, thus a 9 c.c. pipette for taking samples makes the reading on the burette simple, as each c.c. represents ·10.

A fair average of readings in the different stages of manufacture is as follows, with a solution of decinormal strength :—

Test at setting, from	·18 to ·22
„ after cutting, from	·16 to ·18
„ drawing whey off, from	·20 to ·24
„ when curd dry on racks, from ...	·30 to ·35
„ ready to mill, from	·85 to ·90
„ ready to salt, from	1·0 to 1·10

NOTE ON THE BLOWN-SHEEP FLY IN THE WESTERN COUNTRY.

IN regard to the results of my investigations into the habits of the "Blown-Sheep Flies" in the Bourke District last month, when I visited Beemery Station, as it was thought by some of the squatters that it was not the same fly that was blowing the wool in the west, that I had recorded from the Inverell Districts, it is interesting to find that during the last week a large number of flies have bred-out from blown wool taken from the infested sheep, which all belong to the one species, our large yellow blow-fly (*Callifera villosa*), one of the two that were obtained from Inverell wool, though (*Callifera oceanica*) the "blue-bodied blow-fly" was the commoner form there. This further proves that it is our common blow-flies that do the damage in Australia, while in England it is the common blue-bottles (*Lucilia*) that blow the wool. During my visit in the paddocks and about the sheep-yards the blow-flies were not common, while two or three species of the blue-bottles were very numerous; but in no case has a single "blue-bottle" been obtained from blown-wool in my breeding jars. In regard to the reason of such an increase in blown-wool during the last few years, though it is put down to the dead rabbits being so plentiful, it is probable that during the drought there, where so many dead sheep covered with tainted wool were lying about the runs, that the blow-flies deposited their eggs on such wool, acquired the habit, and followed it up when they found the living sheep with smelly wool on their rumps. —WALTER W. FROGGATT.

Profitable Adjuncts to Farming.

ALBERT GALE.

"DON'T put all your eggs into one basket" is an old saw, and advisably a good one. "Man was not made to live by bread alone" is an older one, but both are intended to have the same purpose in view, and the same goal to be reached. It is not necessary to give any detailed meaning to these old and very wise sayings. "Bring up a child in the way he should go" has a far deeper meaning than to bring him up morally good. It has a four-fold meaning—morally, physically, intellectually, and *commercially*. What shall we do with our boys? is a question that is constantly being asked in every household where there are boys in the family; but what shall we do with our girls? is a problem that is never very seriously contemplated by the heads of these families. "Oh, they will get married" is the general solution of the difficulty. There are certainly far greater opportunities for the employment of females, both old and young, than there were a few years ago. The cupboard had to be kept filled with the staff of life and its appetising adjuncts by the male members of the family. Women are now elbowing into occupations that were once the exclusive privileges of men.

Domestic life in our metropolitan and country towns has a great sameness about it—house-cleaning, washing, and cooking is the round from year's end to year's end. With most of the fair sex there is no eight hours work and eight hours play. A woman never knows when her day's work is done. Domestic duties are always on the increase, and far too many town and country girls look upon home life as one continuous round of drudgery, without any chance of monetary pay. It is thus that so many are anxious to stand behind counters and crowding into factories, sacrificing their health for wages.

What are the remedies? Encourage the girls to take an active interest in out-door vocations in beautifying the surroundings of their own homes. Floral culture; growing herbs and salads for the use of the home; raising the more delicate varieties of kitchen vegetables; poultry and bee-keeping; and there are many other out-door pursuits that are both healthy and lucrative. The looking after these things will become attractive and a source of pocket-money. No home in which even one member has a love for the culture of trees, flowers, vegetables, bees, and poultry can be dull and unattractive. It will be a financial gain to parents to foster any inclination their boys and girls may possess to spend their leisure in beautifying the home, adding to the luxuries of the table and in cultivating the common sense that must go hand in hand with the successful management of these industries. It would be a glorious thing for the world at large if those destined to be the mothers of nations could be reared and passed into womanhood amid the peaceful sanctuary of home pursuits, rather than they should crowd into the city for employment.

Occupation of the land in Australia does not mean the same as in older countries, where the first aim of the husbandman is to produce something upon which to raise a family. Farming here is very often solely confined to the production of something that can be sent to market, something that can be sold, something that other people can make use of, while the producer and his family look to the storekeeper entirely for their food supply in the shape of tinned fish and meat, condensed milk, canned fruits and vegetables, case-eggs and over-sea onions and potatoes. Too many that are on the land simply do not realise their own capacities and the means at hand to produce from their own land their own table supplies, overlooking the fact that a penny saved is a penny earned. In rural economy there are many ways open to earn money by saving expenditure. If the Land of Promise was a territory overflowing with milk and honey, New South Wales is, to a large extent, a counterpart to that far-famed land. The industry that bids fair to take the lead here is dairying, and Nature has been lavish in her provision for the other staple food of promise—honey.

I am not recommending bee-keeping as an independent industry. The localities where the bee industry will be a success in a commercial sense are few and far between. If it pays to keep poultry for your own domestic purposes; if your garden can supply the table with fresh vegetables; if you can grow fruits in sufficient quantities for preserving and jam-making to supply the family with this essential change of diet—then it will pay to keep bees as a part of economic household management.

When Lord Ludley started fruit-growing in England on a large scale for the purpose of jam-making, the late Mr. Gladstone called the farmers' attention to fruit-growing as one of the methods of alleviating the distress then existing in the Home rural districts, and he added: "Sugar is cheaper here (England) than in any other country." Honey is as good a preservative for fruit as sugar, and if the fruit and honey be home-grown, the storeroom may be filled with wholesome delicacies at the mere cost of labour and bottles. The price of sugar in this State need not, therefore, deter the house-wife from putting up her supplies of home-made preserves.

Numbers of ladies in all parts of the civilised world are deeply interested and engaged in practical bee-keeping, especially in the rural districts of both Europe and America, and also in the suburbs of the cities and towns of the aforesaid continents. One American lady's name is as a household word among bee-keepers as a rearer of queen bees. Ladies, as a rule, are very timid when among bees; I suppose this timidity is as inborn in some ladies as it is to scream at the sight of a mouse. I have met with others who can handle bees equally well with any of the sterner sex—that is, after they have been taught or shown how to do so. The Hawkesbury Agricultural College apiary is fitted with all the necessary accommodation and appliances for giving ladies an opportunity to learn the practical management of a bee-farm and the handling of bees. The handling and the practical management of bees does not require a

seven-years' apprenticeship—a few lessons from an expert bee-keeper will be enough to give an insight into keeping a few colonies of bees for home use. With modern appliances the danger of being stung is reduced to a minimum. An insight into bee-keeping is always interesting and seductive.

The question, "When is the right time to take the honey?" has now become unnecessary; because, with the bar-frame hives, the apiarist has the bees under control and can ascertain the state of the stores in a few moments. The carpentering work that was so necessary in the early days of the bar-frame principle has been removed by the introduction of cheap machine-made hives, frames, sections, &c., so that lady bee-keepers are no longer dependent on the male portion of the family to aid them in the making of hives, &c.

Mixed farming is now seriously recommended in every periodical dealing with agricultural subjects, especially where there are only small holdings; but it has more or less to do with the work done by the men of the establishment.

There are many crops that can be cultivated by the girls of the household that are more or less profitable. The housewife who looks after the poultry will find it but little additional labor to look after bees. Catching the swarms and hiving them is one of the first steps to be learned in bee-culture. This can be done by any school-girl after she has had one or two lessons; these lessons can be obtained by watching others hiving a newly-caught swarm. There is really no danger to be apprehended from the bees by their attacking the person hiving them. During swarming bees put on their very best behaviour. Bees are always more docile when there is plenty of honey coming in. To remove a swarm from where it has alighted and put them into a reception box, and to transfer them from it to their new home, is an extremely simple matter. If small profits and quick returns be the soul of trade, so strong colonies and big returns of honey is the soul of bee-keeping. "God never sends mouths unless he sends food to put into them" may be all very true, but too often the food goes to one house and the mouths to another. Nevertheless, the two can be brought much nearer together than they are by a little thought, coupled with a little action. A work or book on "Mixed Farming for Farmers' Wives" would be very acceptable in this infant Commonwealth. It might embrace fruit-growing, such as red, black, and white currants, raspberries, strawberries, gooseberries, &c., and the preserving of the same with honey obtained from your own bees. All the foregoing fruits when in blossom yield honey, and if the growers' own bees do not gather it other people's will. Far more of these fruits could be grown for jam-making and preserving than any one family could use. The overplus could be sent to market, and the returns expended in little frocks and boots.

In Berkshire, and other places in England, filberts and other hard shell nuts are grown for export. Why not here in New South Wales? We import nuts from elsewhere. Why not grow them? In this State there

are many districts suitable for their culture. In Holland the Dutch women grow large quantities of flowering bulbs for the English and other markets. Here there are many districts where our farmers' daughters could do the same. If these bulbs were grown within easy reach of a railway station, additional profit could be secured by forwarding the cut blooms to the Sydney or some other market as is now done by many florists around the metropolis. Indeed, growing flowers for cutting and forwarding to the markets is a good paying occupation. The growing of medicinal and other herbs would give a fair return in pin-money. A hundred and one other things could be added that would help to keep down the butcher's, the baker's, and the storekeeper's bills.

Spraying for Codling Moth in South Australia.

In reference to the statements made by members of some of the deputations of fruit-growers who have waited upon the Minister of Agriculture, in protesting against spraying being insisted upon in the proposed Codling Moth Act, that these regulations had been suspended in South Australia as useless, the following extract from a letter received by the Government Entomologist from Mr. Quinn, Chief Inspector, South Australia, is very interesting. He says:—"The field regulations have fallen into abeyance because our growers have had such wonderful success, and have so unanimously adopted the use of the arsenite of soda in lime-water spray (Kedzie's formula), that we no longer consider it necessary to insist on bandaging, &c., though many still adopt the practice purely on their own account as an auxiliary method of prevention. The use of the spray has become so general that I have no hesitation in saying that our increased export has been mainly due for the past two seasons to the much larger quantity of sound apples resulting from the work. I can compare the effect of its rapid adoption to nothing but the utilisation of the phosphatic fertiliser by our farmers, so greatly has it raised the hopes of our apple-growers here. I append a few names, each a leading grower in his locality, with whom I would suggest you communicate if you desire proof from "the man behind the pump." To this Mr. Quinn appends eighteen well-known names.

Kedzie's compound, which is now much used in preference to Paris green among the apple-growers as being more effective, is composed of the following materials:—

White arsenic	1 lb.
Washing soda	4 lb.
Water	1 gallon.

The materials are boiled until dissolved, which takes only a few minutes.

When making up for use, add 40 to 50 gallons of water to a pint, and 2 to 4 lb. of fresh slacked lime. The stock mixture can be put away if not used at once, and will keep for any length of time if corked up. This wash has been used in the Orange district with great success against the pear and cherry slug, which dies as soon as the spray hits it.—W. W. Froggatt.

Farmers' Fowls.

[Continued from page 671.]

G. BRADSHAW.

Chapter X.

Breeding Wyandottes.

When introducing the present series of articles, it was mentioned that during their course there would be some departures from the beaten track of poultry literature, and already this has been done, the last chapter which gave the standard for judging being one of these departures.

Hitherto poultry-books dealing with the subject of judging mysteriously appended the standard at the end of all the descriptive matter about the breed. An instance may be given of the breed now under consideration—Wyandottes. The works in question correctly tell us how to secure the yellow legs, the rose comb, the red ear, cobby build and colour, and after all this conclude their work by giving the standard which says the legs must be yellow, the lobes red, the build cobby, &c. It will be apparent to the merest tyro that the description of a breed, *i.e.*, the standard which tells all about what the shape, colour, and peculiarities of a breed are, should rightly appear early in the work, the writer following with information as to how these features can be secured.

In now devolves how best to produce the shape, various colours, and other characteristics demanded in the standard for the many varieties of Wyandottes. Of course, it may, or can be said, with reason, that in farmers' fowls, that is fowls best suited for the farmer, it is of little account that the shape or colour conforms to some, perhaps arbitrary, provision stated in some book or demanded by poultry judges; that eggs and meat are not dependant on the colour of a fowl's beak, or whether its legs be bright yellow or a pale primrose colour. This is largely true, but only so in a certain sense, for as already shown many farmers have discarded the too common hen in favour of pure breeds, and should any of these breeds be Wyandottes, it is not sufficient to secure a stock of such, and allow them to breed at their own sweet will, as was allowed with the common sort, for, if so, the progeny in a very short time would, so far as appearance go, be of a varied nature indeed.

Wyandottes, as has been shown, are a comparatively new breed, in fact they are described by Harrison Weir and some of the old writers as crossbreds. They certainly have been produced from other pure breeds, and, by scientific mating and selection, will produce their kind, but only in a kind of way as will be shown.

A farmer purchasing, say, the best first prize cock at the Royal Show illustrated in this number, and the first prize hen of the same breed, would naturally expect to breed from them a large number equal to their parents in appearance, and go on breeding as was done with the mongrel sort, and continue increasing his Wyandotte flock, and retaining the colour and type of the variety. Such is not so. From this pair of birds as above, if unrelated, it is just possible that out of the first fifty of the progeny there might not be a single specimen

Mr. W. H. Lathlean's imported Silver Wyandotte Cock.
Winner First Prize at Royal Agricultural Show, 1905.

equal to either parents in lacing or other colour characteristics. But even if there were a few as good in appearance as those they were bred from, if allowed to run and breed together without selection by the owner, the colour and markings of the entire flock, in a very few years would possess little of its former beauty, and in appearance little better than that of ordinary fowls. In process of time a single comb would appear on some specimen, the result of a throwback to an early ancestor—this feature would be reproduced in increasing numbers; feathered legs from the same cause would be in evidence, and would

become still more pronounced as time went on; the markings each year would be more diffused, and before many years the entire Wyandotte stock would be that in name only. During the time that this process of deterioration was going on the same cause would be contributory to a diminishing egg-yield and all showing that the simple fact of purchasing Wyandotte stock of the standard quality is insufficient for the owner whose object is meat and eggs, for it must be remembered that the farmer or other breeder, who keeps and correctly mates and breeds pure poultry of any breed, will always be able to dispose of a quantity of eggs for hatching purposes, at considerably more than the ordinary market value, hence a knowledge of the peculiarities of the strains of his stock and experience in mating will prove principal factors in keeping a stock of fowls not only pure-bred, but pure-looking, and considerably more profitable withal.

The silver variety of Wyandottes, being the first originated, it might readily be accepted that twenty or more years should have been sufficient to have established the colour or markings in the variety to an extent embodying the old principle of like producing like. This certainly has been accomplished to an extent, seeing that most of our present-day Wyandottes will produce stock equal, or better, than those existing twenty years ago. This, however, does not satisfy fanciers, who are always ambitious of producing higher ideals than those existent, and the extent to which this has been accomplished will be best realised by the fact that the birds which won first prizes in the Sydney shows a few years ago would be well rewarded with but a commended card if shown at the present day. Smoky hackle feathers, and rusty feathers on back, too white or too black on breast, was then of common occurence in the male birds, while the hens were badly laced, and much trouble in getting specimens free from the objectionable mossy or peppery saddle feathers. Of recent years these faults are scarcely in evidence, many of the birds now exhibited being close up to the standard requirements. The standard tells us that the cock's beak should be horn colour, shading into or tipped with yellow, the eye bright bay, and the comb, face, ear-lobe, and wattles bright-red, the shanks and feet bright yellow. Neither amateur or professional breeder will experience much difficulty in procuring from even moderate specimens the above requirements. At the same time, white frequently appears in the ear-lobes, and even in good exhibition stock. However, white in ear-lobes is not white lobes, as is seen in the Mediteranean breeds, but rather white in a more or less degree on an otherwise red ear. An absolute white ear, if ever seen, would be a disqualification when being judged; but if white in ear a deduction of from one to six points would be mentally taken off the bird's comparative degree of perfection, according to the quantity of white which appears. For the purpose of the standard all the sections, as has been shown, total 100 points, and many of the best breeders still think that as this white in ear-lobes is such an eyesore, ten, rather than six points should be lost for the defect. During the past few years, several Wyandottes have come out from England showing this objectionable trait, still they were excellent otherwise, and, perhaps, had it not been

for this defect they would have remained in the more profitable show-ground where they were raised. This defect can be eradicated, for if in the male bird, and all the stock hens sound in ear, the defect will appear in but a few of the progeny, and if the faulty ones of these are rigorously excluded from the breeding-pens for two or three seasons it will rarely appear.

Should the original male bird have some excellent qualities, which the breeder desires to retain, he can be re-mated to the sound-bred stock, and although related the white ears will but seldom reappear.

The heads of both sexes have to be white, and it is very rare when any deduction has to be made here, the gravest case only meriting a five-point deduction. The neck in both sexes has to be silvery white, with a clear black stripe down the centre of each feather and free from tick. This latter term is not the insect which a neighbouring State imagines all the Sydney fowls are infested, and demands a clear certificate from officers in the Agricultural Department before such can enter the State in question. The tick of the standard, however, is to the breeder of choice Wyandottes more trouble than the prohibited article, many and almost perfect birds being spoiled from prize-taking by the dark spots or ticks, which often appear on the ends of the neck hackle feathers, and look as a dark fringe or border falling over on the birds' shoulders. This defect is in some specimens most pronounced, and is then called sootiness, and up to eight points can be deducted for this faulty colouring. The illustration of the pen of Silvers, facing page 346, will show the correct marking of this section of the exhibition laced Wyandotte. It may here be added that the white edging of the neck and hackle feathers should be pure white, and the black centre or stripe a dense black; a dull brown is a frequent occurrence and is objectionable. The back of the cock has to be pure white, free from yellow or straw colour, and the shoulder tip or butt white laced with black. The wing coverts well laced, forming two well-defined bars. On the breast and under parts the web white, with well-defined black lacing, free from double or white outer lacing, under colour dark slate, the true tail feathers and sickles black, thighs and fluff black or dark slate. It will thus be seen that the birds have to be black and white, but it is of frequent occurrence that in many otherwise good specimens this white is of a straw colour. This may be the result of exposure to the sun, but there are strains of birds in which this straw colour is implanted and it is most difficult to breed out, and those who are in possession of such, rather than attempt to get rid of it, will do better by disposing of every bird containing such blood and commence again with the now plentiful enough white and black strains. The saddle hackles of the cock should be the same as the neck hackles, this and the preceding constituting what is known in the standard as the back, and for which the faultiness in colour may be so pronounced that up to fourteen points can be deducted; at the same time any bird suffering to such an extent, no matter how good otherwise, would scarcely receive a prize in any show. The under parts must have the feathers white with a narrow well-defined black edging, and free from an outer fringe of white, the lacing to be regular from the throat to

the back of the thighs. In the endeavour to get this narrow lacing another evil has resulted, *i.e.*, the lower part of the feather is right, but the upper part frequently comes without any lacing whatever.

The importance of a well-laced breast is evidenced from the fact that up to fourteen points can be deducted for this fault. The colour of the wings is also an important feature in exhibition specimens. The illustration shows two clearly-defined bars of black across the wings, frequently birds that are too dark in lacing for exhibition purposes excel in these wing qualities. Other conditions are to the colour of the flights and secondaries, but these rarely give trouble. The small soft feathers on the fowls thighs and stern are termed fluff. These should be black or dark gray, often they run to a silver-gray colour, and when so up to six points may be lost. The same number can be deducted for pale legs, while absolutely white legs are a disqualification. For white feathers in tail, or a bad carriage of such, seven points is the extreme penalty. For want of size and condition fourteen points may be deducted. Coming to the hen, it will be seen that owing to the difference in marking from the male bird the points allotted are slightly different in the various sections, but are as approximately alike as the framers of the standard could conceive.

The double-laced feathers referred to above, and which are a serious handicap, is a white or frosty edging, on an otherwise well laced feather, and most frequently appears on the breast of both sexes. Another fault in marking is the spangled feather, this taking the form of that seen on the Spangled Hamburgs. It is a heavy black marking on the feather, but does not extend all the way round. This fault is more frequently seen in the male bird. The mossy or peppery feather is the most serious of the mis-colours in the laced Wyandotte; this is a small tick or fine black spot which appears in great numbers over the white centre of the feathers; if feathers of this sort are plentiful on either sex it is a handicap so serious that the birds need not be exhibited.

All the remarks and definitions referred to above in the Silver Wyandottes apply equally to the Golds.

In later-day breeding operations those desirous of securing the greatest number of show specimens in the progeny resort to what is known as the double-mating system, *i.e.*, a cock or cockerel is mated with certain marked hens or pullets of a known descent, the object being to secure that the bulk of the cockerel progeny will be of well-defined markings, while the pullets may, to all intents and purposes, be valueless as exhibition birds, but most valuable to again mate for breeding good cockerels. The same process is employed in another pen where the object is for the production of exhibition pullets, the cockerels being only valuable to again reproduce similar results. However, this scientific mating is outside the region of those for whom these papers are intended. The farmer who has secured a good pen of any colour Wyandottes need not resort to the above system, for with the standard already given, a brief experience will soon enable him to mate his birds in such a way as to fairly well produce their like, and by continuous mating and breeding, even from the same

family, he can not only keep his stock up to the original colour, but retain all the vigour as well. The most sturdy and well-marked cockerels should be retained each year for breeding, and these mated to a pen each of the highest and darkest coloured hens, and the progeny of each pen duly noted will soon enable the breeder to secure results equal for his purpose to the scientifically-mated stock of the most successful fancier.

Chapter XI.

White Wyandottes.

White Wyandottes, without the slightest reservation, commend themselves as a farmer's fowl. The laced varieties, the Partridge, and other fancy colours may perhaps equal them in egg-production and

Mr. W. W. Smith's White Wyandotte Cock.
First and Champion at Royal Agricultural Show, 1905.

meat qualities, but, if not carefully looked after, will in a few seasons run out in colour and become of a nondescript appearance, a handicap that to the Whites does not apply.

The first thing to secure is type or shape; not the too common leggy sort, but those of full body, broad, deep breast, rather short shanks, and general cobbiness throughout. After this comes the colour, for just as there is a blue and a better blue, so there is a white and a

better white. There are strains of White Wyandottes which are of a straw-yellow colour, and from these the fancier or other breeder need never expect to produce the much admired snow-white specimens.

The following is from the pen of one of the oldest English Wyandotte breeders, the Rev. J. Crombleholme, who writes on this variety: "If I desired to keep Wyandottes for utility purposes only, I should select the White. The White, as a rule, is the plumpest Wyandotte grown, for as there are no markings to breed for, but purity of white only, one need not fear to regularly introduce new blood in the year. As a consequence, the enervation of constitution that follows too much in-breeding does not exist and strong progeny is ensured. Another consequence of this freedom of choice is that the Whites are the best layers. Sweeping assertions of this nature are, perhaps, open to contradiction; but, at all events, my own best shaped Wyandottes are the Whites; they are also my best layers, and produce the most fertile eggs. In breeding Whites we must insist on purity of colour. It is no use trying to get good chickens from sappy parents. There is something in a 'sappy' feather which no one that I know of has been able to diagnose, and which is always perpetuated in young stock. Anyone, then, anxious to breed exhibition chickens must insist on a true white colour in the parents. No matter how big or how fine a cock or hen looks, if they are yellowish or discoloured keep them out of the breeding-pen. When I first began breeding White Wyandottes, I wrote to a noted breeder of White Leghorns, and asked him how he managed to show such *extremely* white birds, hinting that if there was anything in it he might let me know. His answer was that his was a *white strain*. I took it then that he did not wish to tell me his secrets, and let the matter drop; but now, after eight years of breeding, I have come to the conclusion that this white breeder was not joking, but telling a straightforward tale." Mr. Lewis Wright, in the last edition of his well-known poultry-book, writes on the White Wyandotte as follows:—"This variety is one of the two most generally kept in the whole of the United States, disputing with the Barred Rock alone the premier position in the American poultry world. This can only be the case with a white fowl where the poultry interest is chiefly in the hands of the farming class as it is there, and in that country the yellow leg is an added recommendation. But we can add our testimony that a White Wyandotte, besides being a most prolific layer, plucks to a most attractive-looking market fowl, and is most delicious eating."

In breeding Buff Wyandottes the same principle applies as in all other Buff fowls, the yellow shanks and beaks in these making the colour easier to get than in the Buff Orpingtons. A pen of even-coloured birds in both sexes will produce a large percentage of such. So far this variety is almost a stranger on the farms in this country; neither have the fanciers taken to it seriously.

Partridge Wyandottes, although of comparative recent development, are becoming plentiful, but so far are largely in the hands of the fancier, and whether they will be taken up by the farmer is yet a moot question. As egg-producers, like all the Wyandotte family, they are good, one breeder in this State positively asserting that a pen of four

laid over 200 eggs each per year. This is more than double the number produced individually by a pen of this variety at the last College competition, but unfortunately for the variety there was only one pen competing, and just as in the other colours there are good and bad layers, and this particular pen chanced to be the latter. Concerning the merits of the Partridge as table fowls all the Wyandottes are good in that respect, and the specimens shown in last month's *Gazette* may be taken as a criterion of this breed of fowls as meat-producers.

The Silver Pencilled Columbian, and other new varieties like the Partridge, have not yet reached the farmer, and when they do possibly they will be found neither better nor worse than the earlier creation of this plentiful, pretty, and profitable breed of fowls.

Before closing it will be but justice to the breed to reproduce an article from the well-known American poultry judge and journalist, Mr. T. F. McGrew, contributed a short time ago to the *Country Gentleman* :—

"Just twenty-three years ago the original Wyandotte was admitted to the standard. This variety is known to-day as the Silver Wyandotte. A more descriptive title would he "Silver-laced" Wyandottes; and of the Goldens, "Golden-laced." These distinctions are quite valuable in the way of description to the beginner or casual observer. When the Silver Wyandottes came into notice, they, like the Goldens, were managed not to make high quality exhibition fowls, but to make money by selling them broadcast over the land. If these two had been left to stand alone, they would have gone quite out of sight, like the Javas; but, fortunately, from the original came the white specimens that, as White Wyandottes, have carried the whole family to fame.

"No family or breed of fowls possesses more real sterling worth than do the Wyandottes. This value is very prominent with the Silvers, and with the Goldens too. From the very first they have had value as egg producers, as market poultry, for broilers, and as general-purpose fowls. No fowl excels them as a family in all these features of excellence. These were quite as strong in the original Silvers and Goldens as they are at this time in any of the others. These two originals might have been quite as popular if it was not that to have real beauty of plumage is most difficult in their handling, and when clothed in poor or indifferent markings they are not pleasing to the eye.

"No one well informed as to their value would say that they are lacking in any of the utility features that are so valued in the Whites. This being true, one is rather forced to admit the value of plumage colour in market or utility poultry. How foolish any one is to write against the value of attractiveness in fowls! If plain, unattractive appearance should guide, why not place equal value on the plainest-coloured Silver that is laid to the credit of the White? But with such overwhelming evidence of a general preference for the White, there is little chance to get away from this, and all kinds of reasons for placing to the credit of the White the greatest popularity of its family.

"As a favourite colour for the exhibition, for the true fancier and the novice, nothing excels Buff. When the Buff Wyandottes came into public favour, they held for a time the balance of power. They still command considerable attention in the show-room and with fanciers, but this has not and will not extend into what might be called general public favour. Buff Wyandottes will continue to grow in favour. They will extend into many new places; but, with all this, they will not supersede the Whites. Having equal value from a domestic point of view, the Whites have no advantage over them in this way. There must be other reasons for their not being on the crest of public popularity.

"We in this country favour the yellow-skinned and meated poultry. This we find to perfection in the Buff varieties. As to the question of plumage and pin-feathers, the Whites have no advantage over them, and, with all this, public favour follows the Whites. Since the coming of the Buff fowls into notice, no colour has been so attractive from the fancier's standpoint as the buff. The most talented have spent years at producing fowls of the true shade of colour. Page after page has been written on how to produce true buff, yet, with all this, their popularity as general favourites throughout the land has been confined to a limit within a circle of those who select them as an individual preference.

"The Black Wyandotte should be the prime favourite of all black fowls, but even they, with all their true worth, are seldom seen outside of the Boston and New York shows. They are as beautiful in shape, colour, and plumage as any of the Wyandotte family. When dressed, they are fully as attractive and delicate table poultry as are the Whites. They have equal value in every way, but they have not gained in public favour, nor is there much likelihood that that will occur. All they lack is public favour, for they have all the desirable qualities.

"The Partridge Wyandotte has the beauty of plumage of the black-red fowls. Clothed as they are like the Partridge Cochin, nothing could be of truer colour or more attractive character. They came among us with the blowing of trumpets and coloured illustrations; their club has done wonders for them; they are fully the equal of their kind; and while they are but a new variety, they have shown their attractive value, and have gained public attention; but so far they have not obtained the position of prime favourite, that is still held by the Whites, nor is there any evidence that they will.

"Following these are the Silver-pencilled Wyandottes, coloured and marked like the Dark Brahmas. No fowl of any breed or variety excel them in real domestic value. They are most prolific egg-producers, most attractive as show fowls. With all this in their favour, we cannot see why they should not push strongly to the front. At the same time we do not expect to see them supplant the White variety. If this might be, it will surprise all who have in mind the progress, past and present, made by the several breeds and varieties of fowls.

"Following these is the Columbian variety—a true Wyandotte that has the colour and markings of the Light Brahma. For them there is a future.

They will become the centre of attraction for a time at least. It must rest with the general public what position they will fill; but with them, as with others, we cannot see why they should supplant the Whites. At the same time, there will be a continued and increased demand for all these valuable varieties, and those who created and improved these many varieties of this valuable breed did great service toward better meat production.

"The Buff Plymouth Rocks are the single-comb rivals of the Buff Wyandottes. These two have gone along side by side, each having their following and both filling about equal position in public favour. It is recorded that the highest prices paid in late years for fowls have been paid for Buff Plymouth Rocks. They stand well to the front as exhibition fowls. None excel them in this, and they have gained this position as the result of careful breeding. They have every quality that belongs to any of the Plymouth Rock family. They have a right to demand at the hands of the general public equal recognition with any variety. But with them in the same family are the White and Barred varieties, which contend for public favour.

"Personally, we should prefer the White Plymouth Rock to all other American varieties. They have every advantage that belongs to the breed. One might think that the White Plymouth Rock would have as strong a hold on public favour as the White Wyandotte has, but this is not the case; and while the White Plymouth Rock is highly valued, it has not gained equal favour with its rival of the Wyandotte family."

As previously said, the Silver-pencilled Wyandottes are the latest of the new variety, and not much literature is yet available on them. However, since my reference in an earlier *Gazette* appeared, the following has been contributed to an English journal by the oldest breeder of the Silver-pencilled in that country, Mr. O. S. Marshall. The illustration of these, which has already appeared, will show that this later sort for appearance is as handsome as any of the Wyandotte family, while for utility purposes Mr. Marshall's testimony should be conclusive.

"We sometimes hear murmurs, and read of others, decrying the addition to the family of Wyandottes. Some people do not hesitate to call them mongrels, and such would have us be satisfied with what we have already. They argue, the family is already large enough, with Silvers, Golds, Whites, Buffs, Partridges, Buff, and Blue laces, why not be content to perfect these? Happily, there are few such croakers, and it will be a bad day for the Fancy should their suggestions be seriously listened to. In the world, new discoveries and inventions are being continually met with. Some are good, and some bad, but they right themselves by the general law of the survival of the fittest. And so it is with Poultry. New varieties are being evolved by the fancier's skill, some of which are of the meteoric type, make a sensation for a season or two, and then sink into oblivion. I have in my mind a certain variety introduced from the Continent a few seasons ago, from which great things were expected, by some fanciers—I withhold its name for fear of hurting their feelings.

Others continue to increase in favour, and make lasting friends wherever they are known. In this last division I place the Silver-pencilled Wyandotte.

"I do not claim to have had experience of every variety of poultry, but during over 20 years' experience I have never kept any to equal it as an egg producer. I regret now that I did not keep a strict account of the eggs laid by the four pullets in my best breeding pen during the last autumn and winter. They were hatched about the middle of March, 1904, and commenced to lay in September, and they continued to lay all through the winter, without becoming broody until the beginning of April, when one wanted to sit, but was easily checked, and, after a few days, resumed laying. Keeping two other varieties—Partridge and Columbian Wyandottes—I can compare them as layers, and while the two first-named were either stopped by the severe weather, or resting, the Pencils supplied me regularly with their tinted eggs, when the market price was six for the shilling.

"So much for the utility side (and, to my mind, no breed will long hold the public favour without it has utility properties), but read what the exhibition tale is. One pullet was 3rd Dairy, 4th Newbury and Grand International (Alexandria Palace), 3rd York, Bromsgrove, and Banbury. Her sister was 1st Scottish Wyandotte Club, Edinburgh, 1st and special Banbury (here she was given special over the cock class as well as her own sex); the other two pullets were unshown. I mention this because some people have an idea that exhibition birds are not good layers. To such people, I say, try Pencils and you will change your opinion.

"The shortest description of what they are like would be to describe them as having the exact colour of the dark Brahma, with the general shape, size, and characteristics of the Wyandotte. Like the Brahma and many other laced varieties, to breed exhibition birds it is absolutely necessary to resort to double mating. By this is meant the selection of a pen of birds to breed good males, and another pen to breed good females. Briefly, for breeding good males, the lord of the harem must be as near the exhibition type as possible, while his mates need not have the characteristic pencilling and colour of the exhibition females, but they should have good combs, well striped neck hackles, yellow legs, and be as large as possible. For breeding females, the hens or pullets must approach the standard type of the exhibition females. The lord and master of this pen must be pullet bred. That is, he must have been hatched from a similar mating, and if his mother happens to have been a winner, so much the better. He will be of no use as a show bird, because the standard requires him to have a black breast, while the experienced breeder will say, "Give me one for my breeding-pen with white tickings or lacings on his breast and hocks.

"Some people have tried to argue that this double mating is against the popularity of breeds requiring it, and that it ought to be discouraged; but those who wish to have birds fit to win must do it. Time is everything now, and of what use would it be trying to exploit a theory or fad, while our neighbour, breeding the other way, takes

all the prizes? One can easily cite as an example that this double mating does not stop a breed's progress, by calling attention to one of the most popular varieties of the day—the Partridge Wyandotte. Nobody but a novice would expect to breed exhibition birds of both sexes from one pen. I am fully aware that occasionally an exhibition cockerel comes from a pullet-bred pen, and I now have such an one in my yard, but it is one of those freaks of nature one sometimes hears of. The double mating here has not stopped its popularity, as each year it advances by leaps and bounds. It is in the recollection of your readers that only last year at the Grand International Show, a plucky lady—Miss Rilot—gave the hitherto unheard-of price of £165 for a soft-feathered cockerel, and during the season others changed hands for over £50. I admit it would save a lot of trouble if it could be done without resorting to two pens, but if it cannot—well, it is Hobson's choice. The idea is not a new one, as breeders of the Brahma, &c., used it years ago.

"As in the case of the other branches of the Wyandotte family, the Silver Pencil was produced in America and imported into England. To Mr. Brackenbury belongs the credit, I believe, of their origin, and there is no secret how they were produced—mating Wyandotte cocks with dark Brahma, lightly-feathered hens. I believe I am right in saying that this method is a quicker way of attaining the desired end than the reverse mating. To that well-known Yorkshire breeder of Wyandottes (Mr. John Wharton) belongs the credit of first importing them early in 1901. At a later period, Mrs. Campbell and Mr. J. Pettipher founded a strain of their own by a similar mating. The American birds were beautifully pencilled and striking in appearance, but they were undersized, and breeders found it very necessary to introduce Brahma blood to increase the size. This has been judiciously done with gratifying results, producing male specimens weighing up to 9 lb. in weight, a most satisfactory result. Remembering the large number of entries at our leading shows last season, it is remarkable the way they have won favour generally in so short a time. With their splendid qualities to recommend them, one does not require to pose as a prophet to predict still greater success for them.

"At the beginning of this year we thought it was quite time a standard for the variety was drawn up, and also that a club be formed to look after its interests. With that end in view, a meeting was called and held at the Banbury Show last January. The standard has lately been issued, and all the principal breeders have joined the club. The members now number forty, which speaks well for the future.

"As I mentioned earlier, the colour follows that of the dark Brahma, with the bands, to be as numerous as possible, following the shape of the feathers, on a steel grey ground, in the female, while the shape follows the accepted type of the Wyandotte. As regards the weight of the birds, it is rather curious that it has been left to the club to put them up; that is, we think that the Wyandottes generally are underweighted. The Pencil standard reads, 'Size and weight,

rather large, matured cockerels about 8 lb., adult cocks about 10 lb., pullets, 6½ lb., adult hens, 8 lb.' Comparing these weights with the other standards, they will be found to be from 1 lb. to 1½ lb. heavier, and already some fanciers are up in arms regarding it. I would ask them to remember that it has been somewhat of a taunt, generally, against Wyandottes, that they were very nice and attractive birds, but rather small, and now that breeders have increased the size, the standard must be put up, otherwise a judge ought, as a matter of fact, to penalise birds over the standard. Anyone frequenting the shows will readily admit that about all the prize winners of late in Whites and Partridges would have to be put back if this rule had been literally interpreted. Rules must be made for what birds have to be, and not what they are at the time. As our rule was made by prominent Wyandotte breeders, we quite expect to see the rules for the other varieties altered and brought into line with us.

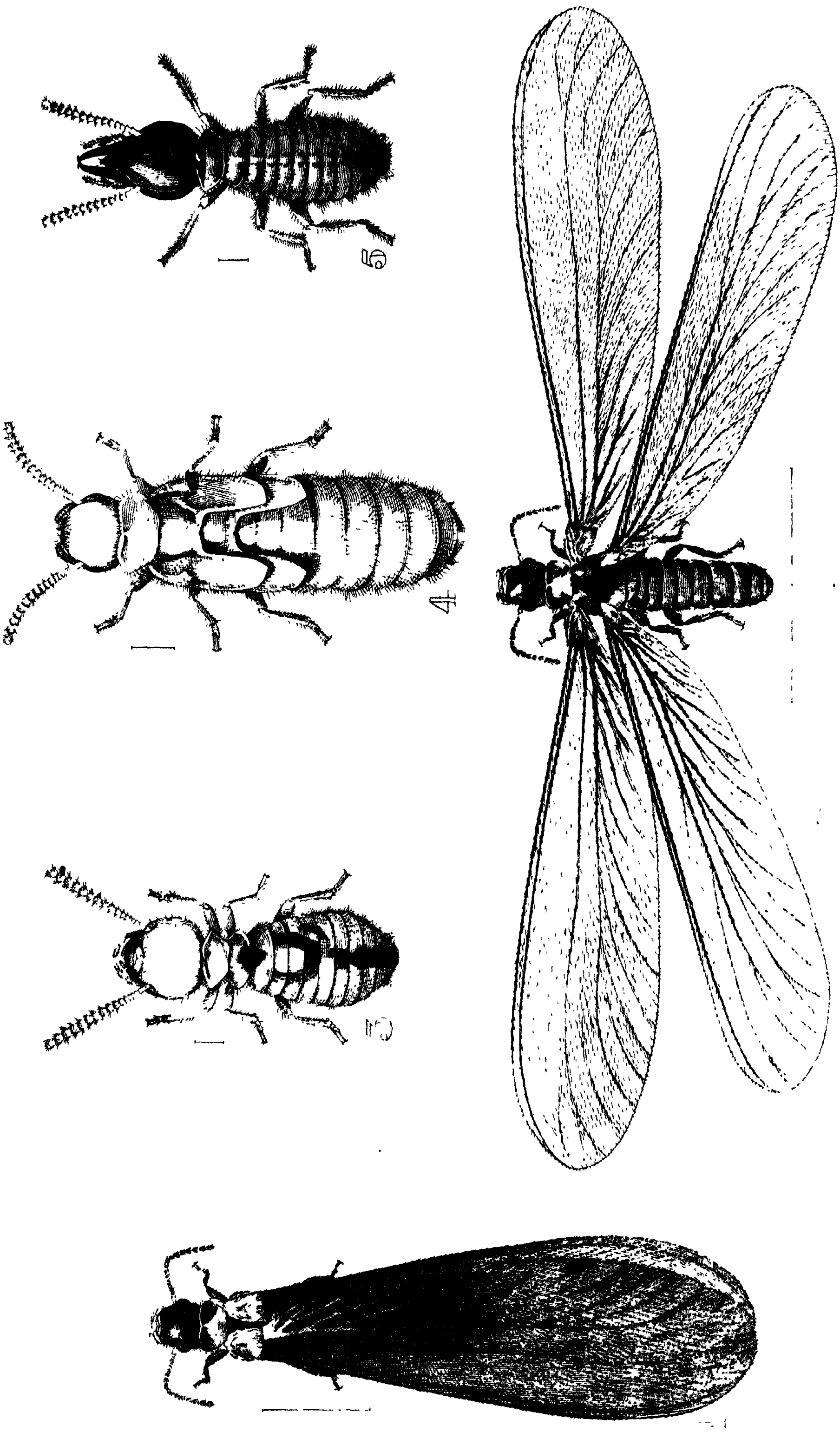
"In conclusion, let me strongly recommend anyone on the look out for a change in their birds to give the Silver-pencil a trial. I am certain it will answer every reasonable expectation, and give them a lot of pleasure and profit."

Pages more could be given of the high opinions held by American and other breeders on the merits of the Wyandotte family of fowls, but sufficient has already been shown, the writer's opinion and experience of them being briefly as follows :—Wyandottes are in every sense of the word a farmer's fowl. There are other breeds and varieties essentially as good, and those who breed other varieties and do well with them should continue doing so. There are, however, some who do badly with other breeds, and if such purpose making a change, then they could do very much worse than give the handsome easily confined Wyandotte a trial, and should their efforts with the new breed still be unremunerative, the privilege to them remains of falling back on the well-worn aphorism, "It won't pay."

(*To be continued.*)

WHITE ANTS ATTACKING FRUIT-TREES, VINES, ROSES, &c.

IN response to a complaint received from Mr. Sydney A. Tripp, of Langley Vale, near Dubbo, that white ants were destroying all the plants in his garden, Mr. Froggatt, Government Entomologist, advised the use of kainit—the roots to be cleaned and the kainit preferably dissolved in water placed well under ground. The soil to be afterwards thrown back. Mr. Tripp reports that the result was a perfect success, with the exception of two plants in his garden. Kainit is procurable in Sydney from any dealer in artificial manures at 18s. per cwt., taken in 2 cwt. lots.



WHITE ANTS

1 and 2 Male and Female Winged White Ants 3 Worker 4 Nymph 5 Soldier

Economic Entomology.

White Ants (*Termitidæ*), with Suggestions for dealing with them in Houses and Orchards.

[Continued from page 656.]

WALTER W. FROGGATT, F.L.S., &c.,
Government Entomologist.

Sub-family Termitinæ.

In this division the scapular shield is angular, slightly rounded above, but transverse below, traversed by four distinct parallel nervures. The costal and sub-costal nervures running parallel but widely separated from each other, with the median and sub-median slender, the former divided into one or more forks at the apex. It contains three well-defined genera, two of which, *Termes* and *Eutermes*, have a wide range, but *Coptotermes* is confined to the Old World and Australia.

It appears to me that the genera of this group represent the typical white ants that probably were in the first instance arboreal insects, like the *Eutermes*, where the soldiers had the head produced into a snout or tubular process above the mouth connected with a chamber occupying the greater portion of the posterior part of the head, which contained a honey-like liquid that could be forced at will through the snout, and be used as a means of offence or defence. In the *Coptotermes* we find an intermediate group of termites that possess the chamber at the base of the head in a more modified manner, connected with a channel opening out as a circular aperture in front of the head, through which a similar fluid can be discharged, but at the same time this is supplemented by a pair of stout cutting jaws with which the soldier can snip off the head of an enemy, as well as smother him with this viscid matter. These may have at one time combined the terrestrial and arboreal habits, and thus connect the true ground-haunting *Termites* which, furnished with a pair of stout cutting jaws, do not possess the apparatus that enables them to discharge an offensive fluid to rout their enemies.

In the writings of Messrs. Silvestri, Wasmann, and recent describers, a number of new genera have been added to this sub-family, but with our present knowledge of the subject I see no reason to split up our *Termitinæ* into more than these three well-defined groups.

Genus I.—*Termes*.

These termites have large rounded heads, furnished with large prominent eyes composed of many facets, small ocelli, situated between the eyes,

and antennæ composed of rounded bead-like segments, varying in number from 13 to 20. The prothorax heart-shaped, flattened and smaller than the head; the wings ample, and often clouded or semi-transparent. The jaws of the soldiers are produced in front of the head and are regular in form, and, when toothed, with the same number of serrations on either side.

This group contains a number of the most typical white ants, many of which build well-defined nests or termitaria, in which they live in countless numbers, or colonies of only a few hundred. Ten species have been recorded from Australia from all parts of the continent.

SYNOPSIS OF SPECIES on structure of head of soldier.

1. *Termes ferox.* Head twice the length of breadth; jaws slender, untoothed, but slightly roughened on inner edge; labrum large; antennæ 15-jointed.
2. *Termes paradoxus.* Head longer than broad, truncate in front; jaws long, slender, untoothed, turning sharply over each other to the base; labrum small; antennæ 17-jointed.
3. *Termes serratus.* Head slender, much longer than broad; jaws slender, standing out in front of head, finely serrate along the inner edges; labrum rounded at the tip; antennæ 13-jointed.
4. *Termes turneri.* Head large, longer than broad; jaws slender, with two sharp teeth near tips; labrum large, rounded at the tip; antennæ 13-jointed.
5. *Termes meridionalis.* Head spherical; jaws curving round at the tips, deeply cut out at base on inner margin; labrum broad, rounded; antennæ 15-jointed.
6. *Termes rubriceps.* Head very large, rounded; jaws large, stout, curving round, angular tooth in centre; labrum very small; antennæ 17-jointed.
7. *Termes errabundus.* Head broad, circular; jaws short, stout at base, with one large upper tooth and two smaller ones below; labrum very broad; antennæ 25-jointed.
8. *Termes perniger.* Head as broad as long; jaws sickle-shaped, with long slender tooth in centre; labrum large, rounded at tip; antennæ 17-jointed.
9. *Termes krisiformis.* Head longer than broad, truncate in front; jaws curved upward, and twisted at tips; labrum small, truncate at the tips; antennæ 14-jointed.
10. *Termes australis.* (Soldier unknown. Described from winged forms only.)

The Snapper White Ant (*Termes ferox*, Froggatt).

The winged termites are common in the nests early in February, and are slender delicate black insects with a very feeble flight; the body is of

a dark chestnut brown, with the under surface much lighter, hairy, and under ½ an inch in length. The soldier is under ¼ of an inch in length, with long, slender, pale yellow head, rounded behind, the sides parallel to the base of the antennæ, and truncate in front; the slender sabre-shaped jaws turning over each other at the tip; the labrum long, narrow, and pointed at the tip. Antennæ long, 15-jointed.

This is a common species about Sydney, living in small colonies under logs or stones, or dry earthern banks, and sometimes forming their galleries in the base of the walls of the milk termites' nest. They seem to have no regular structure in the galleries, which are always well defined, and of a very pale chocolate brown colour when exposed, but run out at all angles. The soldiers are usually very numerous in proportion to the workers, and very pugnacious, turning round, while the paler white workers make for cover, and snapping their jaws together with a distinct click, as the two jaws strike. They all seem very sensitive to light, and retreat to the burrows leading downward as soon as the galleries are broken. The colonies, though abundant in the bush around Sydney, as a rule consist of only a few hundred individuals.

Termes paradoxus, Froggatt.

This species was obtained in small colonies under logs in the Mackay district, Queensland, by the late Mr. Gilbert Turner, and, as far as I know, is local in its range.

The winged termite is of a general light brown colour, with pale fuscous wings darkest near the body, thickly covered with fine hairs, and under ½ an inch in length to the tip of the folded wings.

The soldier has a light yellow-coloured head, with dark ferruginous jaws, black at the tips; head much longer than broad, rounded behind, parallel on the sides, and truncate behind the jaws; the antennæ 17-jointed, slender; labrum broadly rounded at the tip, rather long; the jaws slender, without teeth, springing from the centre of the head, slightly curved, and when at rest crossing sharp over each other. Length under ¼ of an inch.

The Serrate-jawed White Ant (*Termes serratus*, Froggatt).

The winged form of this species unknown. The soldier has a bright ferruginous head, darkest in front, with black-tipped jaws; antennæ and palpi light brown, prothorax pale yellow. The head is long and slender, rounded behind, but almost straight in front behind the jaws. The antennæ consists of thirteen slender joints; the labrum, broadest at the base, parallel on the sides to the spade-shaped apex. The jaws very slender, springing from the centre of the head, narrow at the base and nearly as long as the head, curving in and crossing at the tips, finely serrate on the inner edge. The worker is about the same length as the soldier, viz., 2 lines, dull white with a pale yellow head. This is a rare species, received from Torren's Creek, North-western Queensland.

Turner's White Ant (*Termes Turneri*, Froggatt).

The members of this species construct small nests from 1 to 2 feet in height, of an irregular cone shape, and up to 18 inches in diameter at the base. Turner found the queen's cell about the centre of the nest, nearer the base and of the usual regular form, measuring about 2½ inches in diameter. The dark castaneous winged forms were noticed flying about at Mackay, Queensland, where the nests were plentiful in the scrub towards the end of October; and nests examined at that time were full of winged termites ready to emerge.

I afterwards found nests of this species along the boundary fence between Queensland and New South Wales, at the Tweed Heads, in October, when they also contained winged termites. This brings the ranges of this species a long way south.

The winged termites are under ½ an inch in length, slender and nearly black. The queen has the abdominal plates light brown, and her abdomen measures up to an inch in length.

The soldier is pale ochreous, with ferruginous jaws, black at the tips, and measures under ¼ of an inch in length. The head is large, longer than broad, with the sides straight, curving round in front from the base of the antennæ to the jaws, which spring out from the middle of the head and are slender and untoothed. The labrum, broad and covering the base of the jaws, is rounded on the sides, and spade-shaped at the extremity; antennæ composed of thirteen short slender joints, and the prothorax small.

The workers have the head brownish yellow, with dark spots on the sides of the forehead, somewhat longer than broad, with well-defined sutures in front; the abdomen large, of an elongate oval shape.

The Meridonial White Ant (*Termes meridionalis*, Froggatt).

I have not been able to identify the perfect winged form of this remarkable species, but the form of the soldier is very distinct and characteristic. It has the head almost spherical, slightly longer than broad, rounded behind, and sloping in to the base of the jaws, which are falcate, curving round at the tips, the inner edge smooth from the tip to about a third of the way down, when they are sharply cut out and narrow to the base of the labrum, which is short and rounded. The antennæ, composed of fifteen joints, are slender. The head is bright yellow, with dark ferruginous jaws, and the body very white, the whole insect under ¼ of an inch in length. The worker is broad and stout in proportion to the length, and has a very noticeable white angular patch in the centre of the forehead.

This is the termite that is remarkable for constructing the "meridional" or "magnetic" nests found in the vicinity of the Bloomfield River, North Queensland, and Palmerston, Port Darwin. Mr. N. Holtze, who collected the soldiers and workers from these nests in the Northern Territory, near Palmerston, and photographed the nests for me, says, "These nests average from 10 to 12 feet in length, built in the form of a wall, convex

on one side and concave on the other, the sides respectively facing the rising and setting sun." They average about 8 feet in height, the top straight, crowned with irregular little turrets.

In the "Report of the Horn Scientific Expedition to Central Australia, 1896," Professor Spencer says, "At one spot we came across a small patch of the mound nests of what are called the "meridional" or "compass" ants. These are found in other parts of Australia, such as near Cape York and Port Darwin, and the curious feature about them is that the mound, which is 3, 4, or even 5 feet high, is flattened from side to side in such a way that the broad sides face east and west, and the narrow ends north and south; as it tapers upward it has, seen from the north to south, a wedge shape. There were, altogether, perhaps a hundred of these occupying half an acre of ground, and their shape and bright red colour render them very striking objects. Unfortunately, we met with them in the middle of a long march, when it was impossible to stop and examine them, and my hope that we should afterwards meet with others in similar country was not realized. They are made and occupied by a species of termite, or white ant, and the only other white ant mounds which we saw were a few small grey-coloured ones about 18 inches high on some flats near Lake Amadeus."

A great deal of interest has been taken by naturalists as to the reason of this termitaria always being built on these angles, and Mr. Jack, in a paper entitled "Notes on the Meridional Ant Hill of the Cape York Peninsula," published in the "Proceedings of the Royal Society of Queensland, 1897," after describing their structure, advances this theory: "The reason of their being built at this angle is to secure the maximum of desiccation. They do not repair these nests in the long dry season; but when the wet season sets in repair all damages. Its safety lies in its being dried as quickly as possible. In tropical latitudes it is obvious that this drying can best be secured by placing the longer axis of the structure north and south, so that the rays of the sun may beat upon it during the greater part of the day." A short account of the form of these nests is given in the chapter on Termitidæ in the "Cambridge Natural History," Vol. V, p. 18, with a sketch of a drawing by J. J. Walker, R.N., given to Dr. Sharp Saville Kent has given some fine reproductions of photographs of these nests in his "Naturalist in Australia."

This species has a very wide range over Australia, though it is only in some places that it constructs nests; in other places, it lives in small colonies under logs or stones; and in the latter situations have had specimens from Kalgoorlie (West Australia), Mackay (Queensland), and many inland places in New South Wales.

The Red-headed White Ant (*Termes rubriceps*, Froggatt).

The winged form of this handsome termite is unknown; they live in small colonies in the dry parts of Central Australia, and, during the Horn Expedition, Professor Spencer obtained several small lots. In one tube of specimens was a note that they were taken from a nest at the roots of

a tussock of spinifex grass. Later on I received several tubes containing this species from my father, who collected them in the Kalgoorlie district, Western Australia, so that they probably have a wide range over the interior. The soldier has the head and jaws bright reddish brown, and the upper surface of the thorax brownish; the legs spiny; abdomen covered with short hairs; and measures ¼ of an inch long. The head is very large and broad, rounded behind and on the sides to base of the jaws, which are very stout at the base, curving round to a slender point, with a large angular tooth above the tip of the small rounded labrum; the antennæ 17-jointed, long and slender.

The Large White Ant (*Termes errabundus*, Froggatt).

The soldier is ½ an inch in length, with a bright ferruginous head; black jaws, with all but the abdomen tinted with yellow; the latter as usual being dull white. The head is a little longer than broad, rounded behind right up to the base of the jaws, with the antennæ well round the side of the head, and not so close to the jaws as usual, and are composed of twenty-five slender joints. The labrum is large, rounded at the apex; the jaws short, stout, rounded and curving over each other at the extremity, with a large angular tooth about a third of the distance from the tip. The worker is larger than the male, with a pale yellow short rounded head furnished with very powerful jaws.

This is our largest species of the genus, and is common all over North Queensland, Northern Territory, and the north-west part of Western Australia. It gets into the wood work of houses, into the station storehouses, and is responsible for most of the damage of this kind in North Queensland. The real nest of this species (if it constructs one) is unknown, and they are usually found in small colonies under logs and timber. Mr. Mansbridge, writing from Hall's Creek, Kimberley, Western Australia, says, "These termites were taken from a piece of timber lying on the ground; they are very destructive, and will in a very short time destroy deal boards (to which they are very partial) if left in a dark corner or shady spot."

The Dark Brown White Ant (*Termes perniger*, Froggatt).

The winged forms, or regular nest of this species are unknown, but the very distinctive colour of immense jaws of the soldier easily distinguish it from any other known Australian termite.

The soldier measures about ⅓ of an inch in length, rather stout and broad in proportion; the head is black, with ferruginous jaws tipped with the former colour; the rest of the body and legs dark brown. The head is large, broad, rounded on the sides to the base of the jaws, which are as long as the head, broad at the base, curving round like a pair of sickle blades, crossing each other when at rest, with a slender pointed tooth standing sharply out in a line with the apex of the labrum. The antennæ long and slender, composed of seventeen joints; the labrum large, rounded to the tip. The prothorax is small, flattened and wrinkled; the legs long,

slender, and somewhat spiny; the abdomen large and clothed with fine hairs. The workers are very dark-coloured, the dorsal surface of the abdomen even brown, and quite as large as the soldier.

My father first found these white ants under a log at Kalgoorlie, Western Australia, and wrote, "These soldiers are very savage, when touched exuding a white milky substance, at the same time biting so viciously that if once they caught hold with their enormous jaws, you could pull their heads off before they would let go."

My father later on in the season sent me another lot which he noticed coming out of the ground after a shower; each one of these was clinging to the bit of grass with which it had been picked up by its closed jaws when received in the tube of spirits.

The range of this species is evidently considerable, as Mr. Tryon has shown me specimens of this termite from Charlieville, on the Warrego, Western Queensland.

The Dagger-jawed White Ant (*Termes krisiformis*, Froggatt).

This species was for a long time only known to me from small colonies of soldiers and workers found under logs about Sutherland, near Sydney, but last summer (1904) I came across a number of small rounded nests in the scrub near the Bulli Pass, which proved to be the home of this termite. They were scattered about in the thick forest on the hillside, and were of a rounded form, about 6 inches in height and a foot in diameter at the base, composed of earth more than woody matter, full of irregular galleries and a very primitive queen chamber, with abundance of eggs, but no winged forms. In the end of February, this season (1905), at Noundoc, about 45 miles east of Walcha, in the New England district, in similar forest country, I found this to be a common species, living in small communities under stones and logs; and under one found a large colony full of winged forms, workers, and soldiers.

Winged form (previously unknown) black to dark brown on thorax and abdomen, rest ochreous; wings black, clothed with fine reddish hairs, thickest on abdomen. Length of body 2½ lines; length to tip of wings ½ inch. Head broad, rounded behind, swelling out in front; clypeus pale, rounded, projecting, lobed; antennæ slender, 14-jointed; eyes large, projecting; ocelli small, pale brown, well in front of eyes; jaws small, bright ferruginous, with two slender teeth at tips, smaller one in centre, and large, stout one at base. Prothorax flattened, very rugose, truncate in front, rounded behind; legs stout. Wings long, rounded at tips, scapular shield short, rough. The costal and sub-costal nervures stout, rounded to the tip; medium nervure running through upper half of wing unbranched; sub-median with eight oblique nervures. The abdomen broad, rounded at tip and furnished with very small cerci.

The soldier has a pale yellow broad, somewhat square head, longer than broad, rounded behind, truncate behind the jaws, with slender 14-jointed antennæ; the jaws springing out from the front of the head, slender, turned up, then curved down, of an irregular thickness, again turning

round to the extremity into an auger-shaped tip. They measure ¼ of an inch in length; the worker a little less, but stouter in proportion. The soldiers are very few in proportion to the workers and seldom show fight, hiding as soon as exposed.

The Common White Ant (*Termes australis*, Walker).

The soldier of this species is unknown, as they were described by Walker from winged specimens collected, probably round a lamp. Obtained in South Australia.

The winged forms are light ferruginous, with darker heads, measuring ½ an inch to the tip of the wings.

Walker described workers and soldiers as belonging to this species, but Hagen, who examined the types, says that they did not belong to the winged termite, but were *Calotermes*. I have not been able to discover the nest of this species.

Genus II.—*Coptotermes*.

This genus was created by Wasmann to contain a species of white ant closely allied to the members of the genus *Termes*, but furnished with an opening in front of the head above the labrum and jaws, through which the soldier can discharge a fluid like *Eutermes*, though at the same time possessing the powerful curved fighting jaws of the typical termes.

In other habits they agree with the first genus of this division, building large termitaria, and living in large communities, with large numbers of soldiers. Three species are known in Australia, among them our commonest mound-building species.

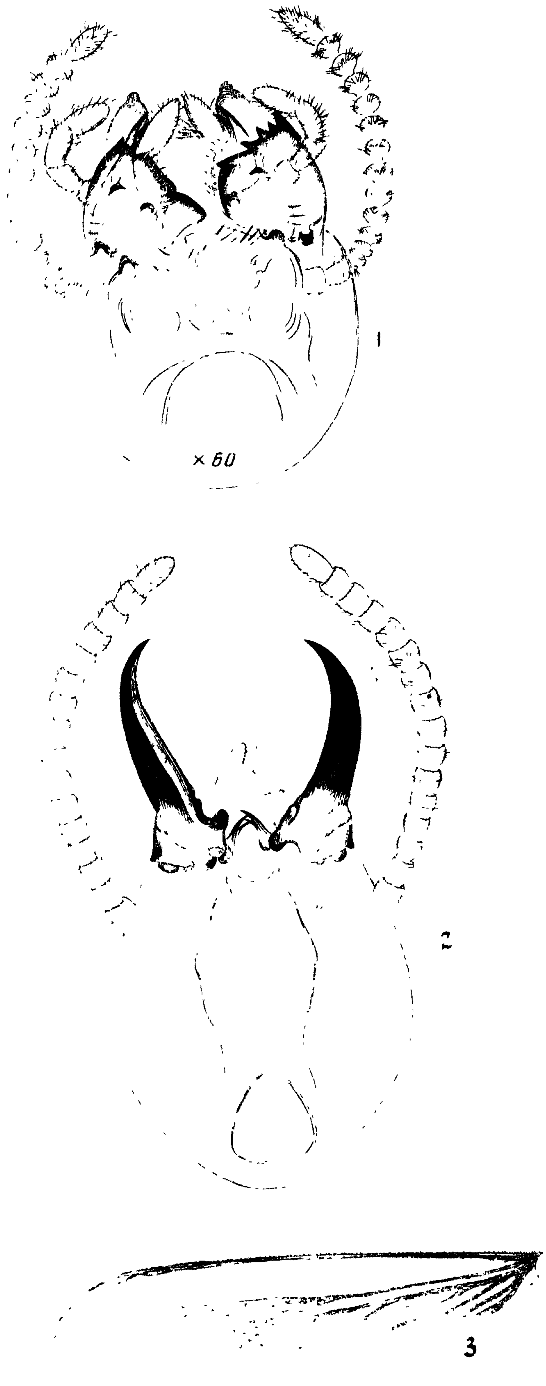
SYNOPTICAL TABLE based on structure of head of soldier.

1. *Coptotermes lacteus*. Head pear-shaped; jaws large, sabre-shaped, untoothed; labrum pointed; antennæ 16-jointed; frontal opening distinct but not projecting.
2. *Coptotermes acinaciformis*. Head broader behind; larger jaws, similar; antennæ 17-jointed; frontal opening situated at extremity of forehead, above the jaws, which are contracted.
3. *Coptotermes raffreyi*. Head smaller than last; antennæ 15-jointed; closely allied.

The Milk White Ant (*Coptotermes* [*Termes*] *lacteus*, Froggatt).

This species was first discribed under the name of *Termes lactis* by me in the *Agricultural Gazette* of New South Wales, p. 297, with plate, in May, 1897, and later on in the same year a technical description was given in the "Proceedings of the Linnean Society of New South Wales."

It is the common species in Australia that is responsible for nearly all the damage done to houses; I have never found any other species of this genus in houses, but one or two species of the allied *Eutermes* often get into fences and outside woodwork in the bush. It is rather curious that while



1 × 60

2

3 × 10

WHITE ANTS (TERMES LACTUS)

1 Head of Worker 2 Head of Soldier 3 Wing of Perfect Insect

the nests of this species are not found about the neighbourhood of Sydney, where they simply form colonies in old stumps, under logs and houses, that they build such characteristic domed nests in other districts. The large termite nest met with along the South Coast, the scrubby country of Colo Vale, Moss Vale, and up into Southern Queensland, is the home of this species. It measures up to 6 feet in height, broadest at the base, tapering very little on the sides, and broadly rounded on the summit. The outer clay covering is very thick and compact, without any opening on the surface except when the workers cut galleries through the walls in November to let out the winged males and females, and as soon as they have emerged the holes are filled up with fresh clay. Enfolded in this clay covering is an irregular mass of granulated, honeycombed, woody matter, which has at one time been wood, but has been chewed up and voided by the insects and produced into a regular papier-mache-like substance; it is seldom in contact with the clay except at the base, and fits to the outward form of the termitarium: The base of the nest, which consists of a regular network of galleries, generally extends about a foot below the surrounding surface of the ground, from beneath which several large galleries lead away into the soil and are the main roads out of the nest to the surrounding forest. Above the network portion of the base of the nest, which is easily detached from the ground, the structure of the galleries becomes more solid, and the royal chamber nearly in the centre of the mass is surrounded with terrace-like solid sheets of a lighter colour, the central chamber being a convex cavity on a level floor about the size of an ordinary saucer; just below on the side will be found more open galleries containing piles of eggs, like semi-transparent grains of sugar, which are removed by the workers from the royal chamber. There are several openings leading off from the floor by which the attendant workers can come in and out, but they are not large enough for the queen, if she is able to move freely (which she is not usually able to do) to get out of her cell. It is noticeable that the egg chambers and queen cell are always situated well above the ground level, so that even if the ground was flooded they are out of danger. Above the queen is a mass of very fine laminated material as thin as brown paper, folding up into fine galleries, curving round into an irregularly rounded ball as big as a man's head, in which the tiny larvæ swarm, and which has been termed the "nursery." The rest of the termitaria consists of more or less solid masses of material, full of chambers and galleries, through which the workers and soldiers are mixed up in no regular order. Sometimes the clay walls contain short galleries in which workers and soldiers are found, but this is not usually the case. In November, on the Shoalhaven, where I opened a number of nests, several were found with keyhole-like slits in the walls, with a cluster of soldiers at the outer opening, with their jaws facing out, standing guard, while behind them the galleries were packed with the winged ones ready to emerge at the appointed time when the soldiers would give free exit, which turned out to be just before sunset.

The winged forms are almost black in colour, with no very distinct characters from several other species; but both the soldiers and workers are very white, with the head pale yellow. The soldier has a somewhat pear-shaped head, with 16-jointed antennæ; large, untoothed curved sabre-shaped jaws, usually meeting or crossed at the tip, and a tubular opening in front above the labrum, through which, when touched, he can discharge a globule of white sticky fluid, by which the species is easily distinguished from any other found about Sydney. It is met with in all sorts of situations, under logs, turning over stones, under dead bark on tree trunks, in the roots or stems of old or damaged fruit trees, and in woodwork of houses. When disturbed the workers always hurry away, but the soldiers only retreat to the entrance of the galleries leading downwards, where they stand with their jaws just projecting and their antennæ moving sideways. If the gap is in the wall of a regular nest, the soldiers remain there until the workers return with grains of earth which they place on the fracture, then turn round, void a drop of what looks like liquid mud, hurry off, while the next one steps in front of the soldiers and places its load on the top of the other, treats it in the same manner, and is followed by another until the opening is soon closed up, and the last one sees is the antennæ of the soldiers waving behind the barricade. The rebuilding of the broken wall, if the damage is serious, is only of a temporary character over the galleries leading in to the nest; they seem to understand that they cannot replace the mass of clay that has been broken out at once; but this is gradually filled in by nocturnal workers who, in a very few days, will replace the gap and level the surface down to its original shape.

The Northern Milk Termite (*Coptotermes* [*Termes*] *acinaciformis*, Froggatt).

This termite differs from the last in the perfect insect having hyaline wings with light brown nervures, and is of a general light brown colour, and clothed with fine hairs. It measures just over ½ an inch from the front of the head to the tip of the closed wings. The soldier has the head larger than the milk termite, broader behind, with 17-jointed antennæ, and large, curved, untoothed jaws, with a similar opening in the front of the forehead. It is somewhat larger, and there is a curious pattern down the centre of the abdomen that is very distinctive.

The first lot of specimens were obtained by Mr. W. O. Mansbridge, at Hall's Creek, Kimberley, North-western Australia, with the information that they were taken from the heart of a gum tree some 20 feet from the ground, and had completely eaten the centre out, only a mere shell remaining; most of the trees in this district are eaten out in the same manner by this white ant. This species was afterwards sent to me, from the Kalgoorlie district, by my father in 1898.

(*Coptotermes* [*Termes*] *rafferyi*, Wasmann).

This species was described by Wasmann from specimens of soldiers and workers which Raffray sent to him, in an Appendix, "Description of a

Termite associated with a Pselaphid," "Proceedings of the Linnean Society, New South Wales," vol. XXV, p. 244, 1900.

These termites and beetles were collected by Lea at Swan River, Western Australia.

Genus III.—*Eutermes.*

In general structure the winged forms are closely allied to the first genus, the chief difference being in the structure of the scapular shield, or basal portion of the wings. They are all dark brown insects, with 12–16-jointed antennæ, with the terminal joints slightly thickened.

In the soldiers the structure is very different, for instead of the double jaws projecting in front the fore portion of the head is produced into a snout (*nasuti*), like an awl, which is tubular, and open at the extremity, connected with a chamber in the head, from which, when the soldier is attacked, it can eject a drop of protective fluid more or less deadly to its enemies. When a nest is damaged, these tiny little soldiers swarm out and stand guard in a most fearless manner until the workers have sealed it up again.

They costruct all kinds of nests, sometimes on the ground, over stumps, grass roots, or under bark and logs, often very small and irregular in structure, though the largest nest known is formed by *E. pyriformis*, in North Australia. The nests formed upon the limbs of trees are constructed by members of this genus. There are seven species described from Australia, and when the country has been explored this number should be largely increased.

SYNOPTICAL TABLE of the members of the genus *Eutermes*, based on structure of head of soldier.

1. *Eutermes magnus*, Froggatt. Head dark, castaneous; hemispherical snout, nearly as long as rest of head; antennæ 14-jointed.
2. *Eutermes triodiæ*, Froggatt. Head darkest on sides of head and snout, almost round; snout short, showing slight suture through head; antennæ 14-jointed.
3. *Eutermes tumuli*, Froggatt. Head reddish orange; snout darker; both head and snout slender, rounded behind; antennæ 12-jointed.
4. *Eutermes pyriformis*, Froggatt. Head reddish brown; tip of snout same colour; head broadly rounded; snout shorter than head; antennæ banded, 14 joints.
5. *Eutermes hastilis*, Froggatt. Head light reddish brown; snout darkest; head broad behind, compressed on sides; snout short; antennæ 13-jointed.
6. *Eutermes fumipennis*, Walker. Head dark chestnut, snout black; head pear-shaped from above; snout slender and pointed; antennæ 13-jointed.
7. *Eutermes fumigatus*, Brauer. Head light-coloured, darkest on sides and snout; head broad behind, tapering to snout, which is short, and broad at base; antennæ 13-jointed.

The Large Eutermes (*Eutermes magnus*, Froggatt).

This species is not uncommon in North Queensland, where it builds a dome-shaped nest, from 2 to 3 feet in height and 3 to 4 feet in diameter, upon dry, basaltic, scrubby ridges. The winged forms emerge in the middle of November, and are remarkable for their size—nearly $1\frac{1}{4}$ inches in length to the tip of the closed wings, and nearly $\frac{3}{4}$ of an inch to the tip of the body—and has 16-jointed antennæ. This is one of the darkest-coloured forms of this genus.

The soldier is under $\frac{1}{4}$ of an inch in length, with the head dark brown, and the centre of thorax and abdominal plates pale rusty red. The head is furnished with long palpi, and fourteen joints in the antennæ; the snout nearly as long as the rounded portion of the head.

The worker has the upper surface of the head brown, with cross sutures of a lighter colour, and 15-jointed antennæ.

The Spinifex Eutermes (*Eutermes triodiæ*, Froggatt).

This is the common mound-building species in the Hall's Creek District, Kimberley, Western Australia, that form their nests on the sides of the slate ridges. They appear to always start by swarming over a clump of spinifex grass, which grows to a height of about 2 feet, and construct a rounded, dome-shaped termitarium, covered with earthy matter on the outer surface, up to 6 or 8 feet in height, rounded at the base, and of an almost uniform diameter to the regularly-rounded apex.

The winged forms are dark brown, with fuscous wings, and measure nearly $\frac{1}{2}$ an inch in length, with the body about $\frac{1}{4}$ inch. The head is large, clothed with fine hairs, and the antennæ composed of fifteen short, rounded segments. The soldier measures about $\frac{1}{6}$ of an inch in length, and has the head dark brown, with the tip of the snout reddish; the antennæ with fourteen slender joints. The worker is slightly larger than the soldier, with the same number of joints in the antennæ.

The Turret Eutermes (*Eutermes tumuli*, Froggatt).

This is the only mound-building species in the Kalgoorlie district, Western Australia, the nests varying from a few inches in height to upwards of a foot, and about the same in diameter at the base, and are always found under the shelter of low, scrubby bushes. During the dry season the nests are uninhabited, and the outer walls become so thin that they crumble away, until the ends of the galleries opening outwards are exposed with the first rain storms.

My father, who made these observations, found them suddenly appear in the previously abandoned nests in March, after the rains, and set to work to mend and patch up the outer walls. In the following October numbers of winged forms were obtained. In these nests he also found large stores of grey pellets, which on examination proved to be masticated grass, rolled up into little balls, a form of food that has not been met with, as far as I know, in any other white ant termitaria.

These nests were recorded during the Horn Expedition from several places under shelter of clumps of spinifex in Central Australia.

The winged form measures ½ an inch in length to the tip of the wings, and just half that to the tip of the body, and is of the usual dark brown tint, and clothed with fine hairs. Antennæ 16-jointed. The soldier has a dull reddish orange-coloured head, with the tip of the snout almost black; the thorax and abdomen brown, with pale segmental divisions. Antennæ slender, 12-jointed. Length of body ⅛ of an inch. The worker with reddish-brown head, the rest of upper surface light brown; a little longer than the soldier.

The Great Mound-nest Eutermes (*Eutermes pyriformis*, Froggatt).

The winged forms have never been obtained from the nests for determination, though probably common just before the wet season. The soldier, measuring under ⅓ of an inch in length, has a reddish brown, smooth, shining head; the base of the snout black and the tip reddish. The worker, slightly larger than the former, has a pale dull yellow head, blotched with brown, and 15-jointed antennæ.

This is the white ant that constructs some of the tallest nests in the world, and comes from the neighbourhood of Port Darwin, in North Australia. These nests average about 4 feet in diameter at the base, running up in a regular fluted columnar form, with irregular projecting buttresses, to a height of fully 18 feet, of an almost uniform width, and terminating in an irregular pointed summit. These nests appear to be built in the first instance over a dead tree stump or broken trunk, which is gradually encased with clay on the outside, while the interior was eaten out, and replaced with granulated masses of chewed wood.

The Red-headed Eutermes (*Eutermes hastilis*, Froggatt).

This is the typical eutermes in the Mackay district, Queensland, where they form small rounded nests about a foot in diameter at the base, but seldom more than half that in height.

The winged form is of the usual dark brown tint, with lightly barred antennæ composed of fifteen joints. It measures ½ an inch in length to the tip of the wings and about ⅓ to the tip of the body. The soldier differs from both *E. fumipennis* and *E. fumigatus* in the bright rusty-red colour of the head, and is intermediate in size between the two. The head viewed from above is pear-shaped; the snout slender and pointed; with 13-jointed antennæ.

This appears to be a local species, and I have not seen it from any other part of the country.

The Common Pale Eutermes (*Eutermes fumipennis*, Walker).

This is the largest of the two species common to this State, and is much lighter in colour than the smaller species. They are found in all kinds of situations, sometimes forming irregular galleries under logs and stones, but often constructing regular rounded domed nests over logs up to 2 or 3 feet in height, but differing from the true termes' nests in having no distinct earthy wall or outside shell, the earthy admixture forming the

The Great Mound-Nest White Ant *(Eutermes pyriformis).*
Palmerston, Port Darwin.

Nest of the Great Mound-Nest White Ant, *Eutermes pyriformis* **(uncommon).**
From Palmerston, Port Darwin.

covering gradually becoming more hard and woody as one comes towards the centre; and the base of the nest extends for some inches below the surface of the soil. They also build the typical "Negro head" nests up in the branches of live trees; these are of an irregular rounded form almost exclusively composed of woody matter, and are soft and friable when broken, and the internal structure is very irregular. I have also found one of these "negro head" nests on the top of a large rock near Manly, probably started over a small stump which had been eaten right out; this was connected with the ground below with regular clay-covered galleries running round the rock, and in all those found in the tree tops galleries always lead down the trunk more or less hidden by the inequalities of the bark, up and down which the white ants are always hurrying backwards and forwards.

The winged forms are of a general light reddish-brown tint, with pale fuscous wings, measuring nearly $\frac{3}{4}$ of an inch to the tip of the wings, and over $\frac{1}{3}$ of an inch to the extremity of the abdomen; the large flattened head furnished with slender antennæ consisting of fifteen joints. The queen measures 1 inch in length and $\frac{1}{3}$ of an inch in diameter. The worker is pale yellowish-brown, the brownish blotched head with a double white suture dividing it, and a reddish spot on either side in front. It measures $\frac{1}{4}$ of an inch in length.

The soldier has chestnut-coloured head, with the snout much darker, and 13-jointed antennæ. It measures $\frac{1}{8}$ of an inch in length. It has a wide range over the whole of Australia, and is found in all kinds of situations, sharing with *Termes lacteus* the credit of doing most of the damage to woodwork of houses and fences in Australia.

The Common Dark Eutermes (*Eutermes fumigatus*, Brauer).

Two species of Eutermes are common in the neighbourhood of Sydney, and are easily distinguished from each other by the size and colour of the head of the soldier. This is the smaller of the two, with the dark-headed soldiers. They appear to never construct nests, but form a network of irregular galleries under logs, sheets of bark, and stones, but sometimes infest old fences or exposed woodwork.

The queen's chamber is often found when turning over the log under which the nest has been made, and has no apparent structure other than that of the surrounding galleries. The exodus of winged termites from the nest takes place early in November; supplementary queens are sometimes found in these nests. I received eight taken out of a nest near Uralla.

The winged forms are dark-brown, with the under surface, antennæ, and legs lighter coloured, measuring about $\frac{1}{4}$ of an inch to the tips of the body, and nearly $\frac{1}{2}$ an inch to the top of the folded wings, and has 14-jointed antennæ. The soldier measures about 2 lines in length ($\frac{1}{6}$ of an inch), and the antennæ are 13-jointed. The worker is as long as the

soldier, with a light brown head, blotched in the centre of the upper surface with a darker reddish-brown tint, with a pale line of suture down the centre; and antennæ composed of fourteen joints. It has a wide range over the coastal districts of New South Wales, and probably will be found extending into the other States.

Prevention and Methods of dealing with White Ants.

Termites are individually very delicate little creatures that can be easily destroyed by any contact poison if once found, and their whereabouts noticed in time; so that it is not difficult to check or drive them away in the first instance.

The food of these insects is wood or vegetable matter of all kinds, and the wonderful instinct or sense of smell that enables them to find their way upwards through feet of clay or brickwork to the wood above is very remarkable.

Therefore, as prevention is better than cure, the more perfectly the house being built is isolated from the ground beneath the better chance there is of keeping out the white ants. The first thing to do before building any kind of house in a district where white ants are known to be troublesome is to thoroughly examine the proposed site for all stumps, roots, or dead wood, and remove everything found; if it is practical to remove all the surface earth that is being built over for a depth of 6 inches or more, so much the better; some foreign authority recently advised deeply ploughing the site first, and claimed that he had never had a house infested with white ants where this practice had been followed.

All floors should be raised above the surrounding level, so high that a man could crawl all over under the building and have access to the woodwork. In many of the cases where houses are badly damaged by white ants the floor joists will be frequently found resting upon or only a few inches off the ground.

In country houses where timber supports or piles are used, they should be charred or tarred, and if ½ a lb. of salt be placed in each hole beneath the post it would be a great preventive; on the top of each a tin or zinc cap should be placed, for, though not everlasting, they help to keep the pests out of all upper woodwork.

Where bricks can be used it is much better to build all supports with them, as they do not attract the termites. The floor joists after they are laid should be thoroughly dressed with wood-preserving oil, to which has been added 1 lb. of arsenic to 4 gallons of oil. If equal parts of washing soda and arsenic are boiled together, the latter will be dissolved and can then be mixed with the oil. This is the basis of all "anti-ant paint" and "white ant exterminators" that are placed upon the market; they can be just as easily compounded at home for less than one quarter the cost. Sometimes after the floor is laid upon the joists the oil will ascend through

the nail holes; but this does no harm, but is rather a proof that the work has been well done.

Of course, it is difficult to perfectly isolate a house from the ground, for often after all the care taken someone may build a flight of steps up to the front without any precautions, furnishing an ideal roadway for the termite; or else someone leans a beam against the wall and gives them another means of ingress. In the country where wood is chiefly used for fuel, and is carted in and stacked close to the house, it is quite evident that logs infested with small colonies of white ants can be easily introduced, which, under favourable conditions, might emerge and find a lodgment elsewhere, and thus get into the house timbers. In North Queensland many of the houses are built upon 11-feet piles, so that there is plenty of room beneath, and in such houses it is seldom that the termites get into the woodwork.

When once the white ants have gained an entrance into a building, the first thing is to find where they started work and the extent and area affected by their depredations. When this has been ascertained, the outer woodwork can be removed, and the damaged timber, where not too far gone, painted with corrosive sublimate (bi-chloride of mercury) which has been dissolved in spirits of wine or water. Sugar or treacle, to which arsenic has been blended, if placed in the excavations they are working, will kill off large numbers, for they feed upon it readily, and even eat the dead ones that have first succumbed to the poison, so that it soon reduces their numbers.

There have been many suggestions made as to the possibility of injecting steam, the fumes of carbolic acid, gas, &c., into the infested timber, but none have been of any practical value. Sometimes the white ants get into a house, and after doing a certain amount of damage, disappear without going any further into the timber. Again, white ants attack a building and may be in it for many years, and it is apparently more or less immune and prevented any serious damage. In the old Naval Depôt, 140 George-street, under the floors there is quite a large nest, which has contained a more or less active colony for many years, yet they never seem to have spread from the large beam where they raised their clay galleries.

The question of white ant resisting or distasteful timber is often raised, and though the hardness or otherwise of wood seems to have little influence on the steel-like jaws of the workers, for they will tunnel through some of our driest dead hard eucalyptus tree trunks with the greatest ease, there is not the least doubt they much prefer some timbers. I have frequently seen red pine boards, round which the white ants have passed, hardly scratched upon the surface, when a clear pine board behind it has been reduced to ribbons. Some of our native woods are much more liable to their attacks, among them sawn stringybark timber. Jarrah is said to resist their attacks, but I have seen a board from West Australia much damaged by them. Desert cypress they are certainly not fond of when sawn up, but in the fallen trees, logs, or telegraph poles they are very

often found hard at work. There is room for valuable experimental work in testing the different timbers as regards their resistant properties to white ants in Australia; something of this kind has been done in other countries. An interesting account is given by H. W. Bates, "On the Prevention of the destruction of Timbers by Termites," in the Transactions of the Entomological Society (London), 1864, Vol. 1, page 185. In "The Technologist" (London), 1865, Vol. V, page 453, the Rev. M. J. Berkeley published an account of termites and remedies based upon a report issued by the Committee of Inquiry into the ravages of the white ants at St. Helena and the means of dealing with them.

In Crichton's History of Arabia, Ancient and Modern (Edinburgh), 1833, an account of the termites destroying live trees is given, which the Arabs protect by plastering the stems with sheep dung. I have been informed by one of my western correspondents that sheep dung has been used in the Hay district to protect trees and timber with very good results. Bossavia states, in an article in "The Technologist" (Vol. V, page 237), that in the gaol at Lucknow, India, a plaster of clay or cowdung mixed with the pulp of the common American aloe was found very serviceable in keeping termites out of the timber.

Orchard trees and root crops damaged.—In the case where live trees are attacked, as is often the case in the drier portions of the interior, it is very difficult to check them, for all the mineral poisons or oils that can be used in the case of timber cannot be applied to living vegetable tissue without damaging the plants treated. In midsummer the watering of the trees only makes matters worse, as it attracts the termites out of the dry soil into the more agreeable moist area. Sometimes the termites come up from below, and finding a weak spot in the trunk or dead root soon burrow up the centre of the trunk, particularly in old peach orchards, so that it is not uncommon to find a large tree snap off, showing the whole of the stem only a pipe covered with the bark. At other times they attack sound fruit trees from the outside, gnawing off the bark below the surface and boring in at the graft scar. In some places nursery stock is greatly damaged in this manner, the bark being gnawed off the cuttings and seedlings. In the case of old trees being infested, the best thing, unless the tree is a very good one and bearing fruit, is to dig it out, roots and all, and burn it with all the termites. The young trees and nursery stock can be cleaned round and washed with carbolic soap, or other strong smelling mixture. In country where the forest comes right up to the orchard fence it is difficult to keep the outer edge of the orchard free from the pests, but if all wood is carefully burned out of the cultivated land, and all logs and termite mounds fired, the orchard will not suffer so much I have in quite a number of cases found that the habit of filling up drains through the orchard with timber was the probable cause of the termites attacking the trees.

Experiments carried out with kainit (German potash) in the Dubbo district prove that it is a good protection to fruit trees when dug in well about the roots.

Glossary.

Labrum	.. Upper lip above the jaws in front of head.
Ocelli	.. Small simple eyes on top of head in winged forms.
Prothorax ..	.. Front portion of body behind the head
Mesothorax ..	.. Second segment of body behind prothorax.
Metathorax ..	.. Third segment of body, to which the abdomen is joined.
Scapular shield ..	.. Basal portion of wings remaining on the body after the wings are detached.
Nervures ..	.. The veins of the wings, parallel or transverse.
Costal nervure ..	.. Front margin of wing, usually thickened.
Sub-costal nervure	.. The nervure running parallel to costal, immediately behind.
Femora ..	.. The thigh of the leg.
Tibiæ	.. The shank of the leg.
Tibial spines ..	.. Spines at the extremity of shank.
Tarsi	.. The toes or joints of the feet, usually terminating in a double claw.
Abdomen ..	.. The hind portion or body proper, generally consisting of 9 segments.
Cerci	.. Short jointed appendages on either side at the top of the abdomen.

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North Australian Curiosities. Gigantic Ant Hills.
An interesting article with illustrations of the Termite Nests near Port Darwin.

(2) **Baumann, E.**
Chemesche Untersuchung von Bruchstuchen, &c.
The analysis of a piece of a termite's nest brought from Somerset, N. Queensland, by Prof. Reuleaux.
S. B. Ak. Berlin, 1882. Pp. 419 424 (with wood-cuts).

(3) **Brauer, F.**
Reise der Novara. Zoology. Neuroptera, pp. 45 49, 1865.
In this is described several Australian species of termites.

(4) **Cunningham, P.**
Two years in New South Wales. 2nd ed., 1827. Vol. I, p. 239.

(5) **D'Albertis, B. L. M.**
New Guinea; what I saw and what I did. Vol. I, pp. 229, 355, and 405. 1881.
Notes their presence on Cape York and Yule Island.

(6) **Desneaux, J.**
A propos de la Phylogénie des Termitides.
Annales de la Société Entomologique de Belgique, XLVII, 1904.
In this paper the author goes into the classification of the termites, and groups them in three sub-families, separating my Genus Mastotermes from the Calotermitinæ, and making it the type of the first sub-family under the name of Mastotermitinæ.

(7) **Desneaux, J.**
Wytsman's Genera Insectorum, pt. 25.
Isoptera, Family Termitidæ, 1904, pl. 1-2, pp. 1–42.
This is a complete list of all the termites described up to the date of publication He places my species of *Glyptotermes* in the Genus *Calotermes*, to which they do not belong, and groups a number of forms which are quite well enough defined to have generic rank as sub-genera. In the Genus *Eutermes* he places a number of species which belong to the Genus *Termes*, and other genera, and leaves them in a very unsatisfactory state

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Figures and describes this insect as a pest to vines. The species is *Termes lacteus*, not *T. australis*.

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A description of all the species known in Australia, Tasmania, and New Zealand.

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Agricultural Gazette of New South Wales, vol. XIV, pp. 726-30. 1903.

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An Elementary Manual of New Zealand Entomology. Wellington, 1892.
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(15) **Jack, R. L.**
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Proceedings of the Royal Society of Queensland. Vol. XII, p. 99, 1897.
In this he describes the structure and reason for the widest portion facing the sun.

(16) **Kent, W. Saville.**
Infusorial parasites in White Ants in Tasmania.
Proceedings of the Royal Society of Tasmania, pp. 271-3. Annals of Natural History (5), vol. XV, p. 450. 1884.

(17) **Kirby, W. F.**
On the Neuroptera recently collected during the voyage of the "Challenger."
Annals of Natural History (5), pp. 453-6. 1884.
Mentions Australian species.

(18) **Le Souef, D.**
A Trip to North Queensland.
The *Victorian Naturalist*, vol. XI, 1894, p. 25.
A general account of the white ants in the vicinity of the Bloomfield River.

(19) **Lord, W. B.**
Shifts and Expedients of Camp Life: Travel and Exploration.
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(20) **Moresby, Captain J**
Discoveries and Surveys in New Guinea. London, 1876. Chap. II, p. 13.
Gives a general account of the ant nests at Somerset, Cape York.

(21) **Moseley, Prof. H. N.**
Notes of a Naturalist on H.M.S. "Challenger," 1892. London. P. 304.
Termites at Cape York, Somerset.

(22) **Naturalist, The,** in Australia. London, 1897.
Chapter IV. White Ants; pp. 101–31, with numerous plates and wood-cuts.
A very interesting account of the nests and habits of Termites in North Australia.

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Insect Life. Vol. I. p. 341.
Note on white ants in Australia, attacking fruit trees in the Goulburn Valley, Victoria.

(24) "**Saturday Magazine,**" No. 330, 26th August, 1837.
An anonymous account of Australian Termites.

(25) **Sharp, Dr. D.**
Cambridge Natural History Insects. Pt. I. 1895. Termitidæ, p. 386.
Gives an account and sketch of the Meridinal White Ant's Nest, furnished by Mr. J. J. Walker.

(26) **Spencer, Prof. Baldwin.**
Report Horn Scientific Expedition. Pt. 1, p. 129. 1896.
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(27) **Tryon, H.**
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An account of a human skeleton the skull of which had been gnawed by termites, the marks of which were supposed to be from a shot-gun.

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Proceedings of the Linnean Society, New South Wales, vol. XXV, p. 214. 1900.
Describes a Western Australian Termite, under the name of *Coptotermes Raffrayi*.

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Catalogue of the specimens of Neuropterous Insects in the collection of the British Museum.
Part I, Termitina. London, 1858. (This was published under Hagen's name, according to Scudder, without his authority, but compiled from his (Hagen's) Monograph.)

Judging Wheat and Flour at the Royal Agricultural Society's Show, Sydney.

F. B. GUTHRIE.

AT the recent Easter Show held by the Royal Agricultural Society in Sydney no endeavours were spared by the promoters to encourage exhibits in the wheat and flour sections to place the judging on as thoroughly satisfactory a footing as possible, and to make the exhibit interesting and educational.

Wheat.

The sum of £40 was set aside for prizes for wheat for competition, and the circular which is reprinted below was distributed, setting forth the objects of the promoters and the details of the competition. £7 were given for the first prize in each class, and £3 for the second, an extra prize of £3 3s. for the best bag of wheat exhibited being given by the Massey-Harris Co. (Ltd.).

Royal Agricultural Society of New South Wales.

"ROYAL" SHOW, EASTER, 1905.

I desire to solicit your earnest attention to the undermentioned prizes for wheat which it has been decided to offer for competition at the forthcoming Show to be held next Easter.

STATE CHAMPION PRIZES FOR WHEAT.

1. **£10 for the best Bag of Macaroni Wheat.**—To represent the very arid areas where this class of wheat can be grown to advantage. This wheat is used for the manufacture of macaroni, and for mixing with bread wheats.

Varieties recommended :

1. Medeah.	5. Kubanka.
2. Belotourka.	6. Velvet Don.
3. Cretan.	7. Black Don.
4. Farrer's Durum.	8. Xeres.

2. **£10 for the best Bag of Hard or Strong Flour Wheats,** such as Manitoba.

Varieties recommended :

1. Power's Fife.	7. White Fife.
2. Improved Fife.	8. Willman's Fife.
3. Hornblende.	9. Minnesota Blue Stem.
4. Mettislick's Fife.	10. Hayner's Blue Stem.
5. Rysting's Fife.	11. Bolton's Blue Stem.
6. Mekendry's Fife.	12. Jackson's Improved.

3. **£10 for the best Bag of Medium Hard Wheats or Straight Flour Wheats,** such as "Bobs."

Varieties recommended :

1. Bobs.	4. Cleveland.
2. John Brown.	5. Come Back.
3. Tarragon.	

4. £10 for the best Bag of Soft or Weak Flour Wheats, such as Steinwedel.

Varieties recommended :

1. Purple Straw.
2. Farmer's Friend.
3. Rattling Jack.
4. Rattling Tom.
5. Steinwedel.
6. White Tuscan.
7. Tuscan Essex.
8. White Essex.

Conditions.

1. State variety.
2. The locality where grown.
3. The character of the soil.
4. The quantity of seed sown per acre.
5. The yield per acre.
6. The exhibit to be from not less than 50 acres.
7. All exhibits to be the property of, and grown by, the exhibitor.

This information to be given on the Entry Form.

The encouragement of wheat growing deserves the keenest attention at the hands of all those directly or indirectly associated with our primary industries.

In the recent annual report issued by the Director of Agriculture, it is shown that the yield in this State averages 17½ bushels per acre over the extensive area that was under crop last year, viz., 1,561,111 acres, the total yield being 27,334,141 bushels; the coastal division of 7,535 acres producing 93,456 bushels with an average of 12·4 bushels; the tableland of 369,780 acres producing 5,999,945 bushels, averaging 16·2 bushels; the western slopes and Riverina districts, 1,175,152 acres, produced 21,132,856 bushels, averaging 18 bushels; and the western divisions 8,644 acres, producing 107,884 bushels, averaging 12·5 bushels. 149,687 acres failed through drought, excessive rains, hail, rust, bush fires, rabbits, &c., the rust alone destroying 84,425 acres. The wheat was grown on 48,240 holdings. The average yield of wheat for the last ten years was 9·9 bushels

In comparison with our wheat production it is interesting and instructive to note the production of other important wheat-growing countries:—

The estimated yield of wheat for 1903 in the United Kingdom on an area of 1,619,053 acres, was 6,102,348 quarters, an average of 31·99 bushels per acre.

Argentina, on 9,127,497 acres, produced 12,575,900 quarters; average, 9·84 bushels in 1899–1901, 1902.

Austria, on 2,609,155 acres, produced 5,644,793 quarters; average 17·46 bushels.

Hungary, on 8,747,144 acres, produced 20 641,837 quarters; average, 17·21 bushels.

Germany, on 4,464,463 acres, produced 16,323,669 quarters; average, 27·12 bushels.

Roumania, on 3,965,973 acres, produced 8,927,743 quarters; average, 14·53 bushels.

Russia in Europe, on 43,755,341 acres, produced 56,647,192 quarters; average, 8·79 bushels.

Siberia, on 5,036,288 acres, produced 8,680,890 quarters; average, 10·4.

The United States of America, on 49,895,514 acres, produced 77,236,238 quarters; average, 13·49.

Canada—Manitoba, 2,442,873 acres, produced 5,014,610 quarters; average, 19·69 bushels. N.W. Territory, 840,647 acres, produced 2,013,946 quarters; average, 19·53 bushels. Ontario, 913,546 acres, producing 2,736,648 quarters; average, 19·77 bushels.

France, 16,144,800 acres, producing 43,998,712; average, 19·72 bushels.

The estimated total quantity of wheat produced by the various continents of the world is given by the United States Statistician as 3,195,858,000 bushels.

The production of wheats in the other States of Australia and New Zealand was as follows for 1903:—

Queensland, 138,096 acres; yield, 2,436,799 bushels, averaging 17·65 bushels per acre.

New Zealand, 230,346 acres; yield, 7,891,650 bushels, averaging 34·26 bushels per acre.

South Australia, 1,711,174 acres; yield, 13,209,465 bushels, averaging 7·72 bushels per acre.

Victoria, 1,968,899 acres; yield, 28,525,570 bushels, averaging 14 49 bushels per acre.

West Australia, 139,297 acres; yield, 1,855,460 bushels, averaging 13·32 bushels per acre.

Tasmania, 49,414 acres; yield, 767,398 bushels, averaging 15·53 bushels per acre.

It will be seen that a vast scope exists for improvement in the annual yields from our wheat-producing areas.

In the selection of wheats suitable for our varied conditions of soil and climate, it is essential that a continuous system of research should be conducted to guide the wheat grower who is called upon at times to confront the most adverse difficulties created by plant diseases and drought.

The Department of Agriculture, under the guidance of its expert, Mr. Wm. Farrer, has in hand the control of extensive tests to determine precisely what constitutes profitable qualities in wheat, and to select the best varieties for this purpose.

The Society's efforts are designed to augment the usefulness of this good work by establishing a series of annual competitions by which the best qualities of wheat grown in the State can be satisfactorily determined.

The aim is to stimulate the production of wheat of high quality, associated with prolific yield; and to disclose by practice special conditions of cultivation, and the most rational methods of maintaining soil fertility.

In arranging the various classes it will be noted that ample provision is made to secure representative collections from every section of the wheat-growing lands in the State.

The prizes offered are liberal, and are intended to provide sufficient inducement to obtain a large number of entries.

It is proposed to establish a sound system of judging the wheats by points, in which the scientific estimation of the grain contents will be dealt with in co-relation with the practical outcome of "strength" from a baking point of view.

F. WEBSTER, Secretary.

The judging of the wheat samples, in accordance with the final paragraph of the above advertisement, was entrusted to Messrs. R. W. Harris, head miller, Gillespie Bros.' Anchor Mills, Sydney; T. J. Murphy, wheat buyer; and F. B. Guthrie, chemist, Department of Agriculture.

It is thought that a copy of their report, explaining the methods adopted by them, will be of interest.

The actual milling of the samples was carried out by Mr. G. W. Norris on the small model mill in the laboratory of the Department of Agriculture.

Their report was as follows:—

Chemical Laboratory, Department of Agriculture,
136, George-street.

Sir,

Re wheats entering for prizes under the auspices of the Royal Agricultural Society, the judging was carried out in the following manner:—

The wheats were placed in their respective classes, and were examined in bulk by the three judges, Mr. Harris, Mr. Murphy, and Mr. Guthrie.

CLASS 630 (Macaroni Wheats).

Only two wheats entered for this class, one of which (No. 3,172) contained too large an admixture of white grain to entitle it to a prize. No. 3,173 was a fair sample of macaroni wheat, but not sufficiently pure, in the judges' opinion, to entitle it to a first prize. (The sample was not milled.) It was therefore awarded a second prize, no first prize being awarded in this class.

CLASS 631 (Hard or Strong-flour Wheats).

Five wheats entered in this class, Nos. 3,176, 3,179, 3,177, 3,174, and 3,175. Of these, Nos. 3,174 and 3,175 were rejected as not being up to the standard, and Nos. 3,176, 3,179, and 3,177 were milled, the result being that the first prize was awarded to No. 3,177, and the second to No. 3,179.

The results of the milling are tabulated in the appendix.

CLASS 632 (Medium Hard Wheats).

Six wheats were entered for this class, Nos. 3,180, 3,186, 3,185, 3,183, 3,181, and 3,182. Of these, Nos. 3,183, 3,181, and 3,182 were rejected as being either inferior or outclassed, and Nos. 3,180, 3,186, and 3,185 were milled, the result being that the first prize was awarded to No. 3,180, and the second to No. 3,185.

Class 633 (Soft or Weak-flour Wheats).

Nine wheats (Nos. 3,189, 3,196, 3,188, 3,190, 3,193, 3,192, 3,187, 3,195, and 3,191) were entered for this class, of which Nos. 3,189, 3,196, 3,188, 3,195. and 3,191 were rejected as not being up to the standard, and the remaining four were milled, the result being that the first prize was awarded to No. 3,192, and the second to No. 3,187.

The accompanying table shows the manner in which the marks were assigned in the different instances, the figures in italics being the actual results obtained on milling, the marks assigned being in Roman figures It must be understood that the marks are assigned only as between wheats of the same class. It does not follow, for example, that a wheat getting 95 marks in Class 633 is necessarily an inferior grain to that which obtained 97 marks in Class 631. The weight per bushel of all samples was taken, and the results are attached.

It is proposed to prepare an exhibit case showing samples of the grain and of the mill products in the case of those wheats which were milled, so that competitors and others interested can judge of the nature of the flour, bran, &c., obtained from the different wheats.

We would like to point out that some difficulty was experienced in judging Class 632, as the use of the expression, straight-flour wheats, is misleading, and was a cause of misunderstanding both to competitors and judges. We would suggest that in future this class be omitted, and the wheats classified as macaroni, hard or strong flour, and soft or weak flour.

If it is thought desirable, a special class might be made for departmental cross-bred wheats.

R. W. HARRIS,
T. J. MURPHY,
F. B. GUTHRIE.

Weights per Bushel.

Class	Sample	lb per bushel
630	3172	59½
	3173	64
631	3176	61¾
	3179	62½
	3177	62
	3174	65
	3175	62¾
632	3180	65¼
	3186	64¾
	3185	62¾
	3183	59½
	3181	63¼
	3182	63¾
633	3189	63¼
	3196	64¾
	3188	62¼
	3190	64
	3193	65
	3192	64¼
	3187	65¾
	3195	62
	3191	65

RESULTS OF MILLING TESTS.

	Appearance of Grain.	Weight per Bushel.	Ease of Milling.	Percentage of Flour.	Colour of Flour.	Percentage of Dry Gluten.	Strength.	Total.
Maximum Marks.	10	15	10	10	15	20	20	100
				Class 631.				
Show No.								
3177	10	15 [*62¾*]	10 Fair to mill.	10 [*75·4*]	14	18 [*12·39*]	20 [*57·0*]	97
3179	8	14 [*62½*]	10 Fair to mill.	7 [*68·7*]	15	18 [*12·27*]	18 [*56·0*]	90
3176	8	11 [*61¾*]	10 Fair to mill.	7 [*69·3*]	11	20 [*15·3*]	19 [*56·5*]	87
		Class 631—First prize, No. 3177 ; second prize, No. 3179.						
				Class 632.				
3180	9	15 [*65¼*]	10 Fair to mill.	10 [*70·6*]	11	20 [*10·0*]	20 [*53*]	95
3185	10	10 [*62¾*]	10 Fair to mill.	9 [*68·5*]	15	20 [*10·0*]	15 [*49*]	89
3186	5 . . .	14 [*64¾*]	10 Fair to mill.	9 [*69·5*]	13 .	20 [*9·9*]	12 [*47*]	83
		Class 632—First prize, No. 3180 ; second prize, No. 3185.						
				Class 633.				
3192	10	13 [*64¼*]	10 Fair to m .	10 [*69·0*]	12	20 [*10·6*]	20 [*51·8*]	95
3187	9	15 [*65¾*]	10 Fair to mill.	10 [*69·0*]	15	18 [*9·6*]	17 [*46·5*]	94
3190	7	13 [*64*]	10 Fair to mill.	10 [*69·7*]	14	20 [*10·7*]	18 [*47·6*]	92
3193	8	14 [*65*]	10 Fair to mill.	10 [*69·1*]	14 . .	17 [*9·0*]	17 [*46·5*]	90
		Class 633—First prize, No. 3192 ; second prize, No. 3187.						

AWARDS.

Class 630.—First prize (not awarded) ; second prize, No. 3173—Wm. Fryer.

Class 631.—First prize, No. 3177, W. G. Reinhard ; second prize, No. 3179, John Stein.

Class 632.—First prize, No. 3180, A. Eulenstein; second prize, No. 3185, Fred. Rentz.

Class 633.—First prize, No. 3192, George Linden; second prize, No. 3187, Clinton Bros.

Champion Prize, for best bag of wheat exhibited.—No. 3177, W. G. Reinhard.

R. W. HARRIS,
T. J. MURPHY,
F. B. GUTHRIE.

The Secretary, Royal Agricultural Society, supplied the following particulars with the principal prizes taken, which will be of interest to present and future exhibitors.

Class 630.—Macaroni. Second prize (first prize not awarded), Wm. Fryer, Luddenham; variety, Belatourka; grown at Greendale, Luddenham, on clay soil; 1 bushel seed per acre; yield per acre, about 8 bushels; season very dry; not more than half usual crop.

Class 631.—First prize (and champion prize for best bag exhibited), W. G. Reinhard, Oldfield, near Wellington; variety, Manitoba; grown on chocolate soil; sown at rate of ½ bushel per acre; yield, 10 bushels per acre. Second prize, John Stein, Grenfell; variety, Manitoba; grown on chocolate soil; sown at rate of ½ bushel per acre; yield, 15½ bushels per acre.

Class 632.—First prize, A. Eulenstein, Henty; variety, "Bobs"; grown on sandy loam; sown at the rate of 18 lb. seed per acre; yield, 22 bushels per acre. Second prize, Fred. Rentz, Grenfell; variety, "John Brown"; grown on loose, red soil; sown at rate of 30 lb. per acre; yield, 32 bushels per acre.

Class 633.—First prize, George Linden, Wagga; variety, Marshall's, No. 3; grown at Gobbagombalin, near Wagga, on loose chocolate soil; sown at rate of 36 lb. per acre; yield, 18 bushels per acre. Second prize, Clinton Bros., Corowa; variety, Steinwedel; grown on heavy clay soil; sown at rate of 45 lb. per acre; yield, 22 bushels per acre.

The wheats on the whole were an exceedingly good lot, the only disappointing ones, both in number and quality, being the macaroni class. Only two samples were sent in for this class, both by the same grower, and neither of them were true macaroni wheats, and were largely mixed with white grain.

In view of the great value of this class of grain as a fodder-crop, its prolificness, and power of resisting drought, it is to be hoped that more attention will be directed in the future towards its cultivation. This class of grain is even being used, in small quantities, by American millers for mixing with other grain in the production of flour.

The exhibit that obtained the first prize in the hard-wheat class, and also the prize for the best bag of wheat shown (from a miller's point of view), was a sample of Manitoba wheat, a result on which the Agricultural Department is to be congratulated, since they have consistently advocated the cultivation of this class of grain in suitable districts in New South Wales.

An exhibit was prepared, showing the different grains, in sample bottles, and also specimens of the different mill-products obtained—flour, bran, and pollard—so that an opportunity was afforded of examining and comparing the mill-products obtainable from the different wheats which obtained prizes, or which ran the prize-winners close. This exhibit was placed alongside the samples of grain exhibited.

Flour.

In the case of flour, first and second prizes (certificates) were awarded to wheaten flour, first quality, and wheaten flour, second quality.

The report of the judge is appended, and explains the method of judging and the way in which the awards were made. There was no time to enable a baking-test of the flours to be carried out, as the samples were only received on the day before Good Friday, and the awards were made on Saturday.

It would be a considerable advantage if it were possible to get the samples in a few days earlier on future occasions, so as to enable a baking-test to be made, as this provides the most conclusive information regarding the quality of a flour, and the addition would make the judging more complete and satisfactory.

Chemical Laboratory, Department of Agriculture.

Re judging wheaten-flour exhibits: These were examined more particularly for their appearance, colour, gluten-content, and strength, or water-absorbing quality—these last three being the characteristics on which their baking quality depends.

Points were awarded as follows:—

Strength	=	35
Gluten-content	=	35
Colour	=	30
		100

The accompanying table shows how the marks were assigned to each flour. Exhibits 3821 and 3822 were very low in gluten—too low, in my opinion, to make nutritious bread. No. 3828, on the other hand, is a very weak flour. All the flours were weak, with the exception of Nos. 3821 and 3822, which are excellent flours, except for the serious deficiency in gluten.

The colour and general appearance of all flours were excellent, Nos. 3821 and 3827 being rather starchy in appearance.

TABULATED RESULTS OF EXAMINATION.

		Strength.		Gluten.		Colour.	Total.
1st Quality.	3821	35	*(53·6)*	20	*(6·9)*	22	77
	3822	35	*(51·6)*	20	*(7·0)*	27	82
	3823	30	*(48·2)*	25	*(7·5)*	25	80
	3824	30	*(48·0)*	35	*(11·0)*	30	95 (1st)
	3825 } 3826 }	30	*(48·0)*	30	*(8·7)*	25	85 (2nd)
	3827	30	*(48·6)*	30	*(8·2)*	20	80
	3828	20	*(46·6)*	30	*(8·5)*	30	80
2nd Quality.	3829	35	*(52)*	25	*(7·3)*	20	80 } equal.
	3830	35	*(51)*	30	*(10·1)*	15	80 }

Marks assigned, in roman figures; figures obtained on analysis, in *italics*.

AWARDS.

Classes 744 and 745 (cereals, wheaten flour, first and second quality).

Class 744.—First prize, No. 3824, Pyke Brothers; second prize, No. 3825–3826 (one exhibit), Wilson Brothers and Oram.

Class 745.—First prize (divided), No. 3829, R. Dowling; No. 3830, Pyke Brothers.

F. B. GUTHRIE.

Starting a Small Farm in the Glen Innes District, N.S.W.

[Continued from page 548.]

R. H. GENNYS.

It is generally very advisable to erect a small horse paddock at the outset of operations, and will result in much valuable time being saved that would otherwise be spent in hunting after stray animals. Before fencing in land of any kind with a permanent fence, it would be better to remove all branches overhanging the line, or any timber that may be liable at any time to fall and injure the fence. This is an expense that will not require to be incurred again during the life of the fence, and that cannot be done as satisfactorily when once the fence is erected. It will be sure to save much trouble and anxiety in the future.

Good fencing timber in many parts of New England is very scarce, a large proportion being White Gum and a considerable area Peppermint, both bad timbers for lasting in the ground, although Red Peppermint is said to be fair, and as good as any in wet land. In ordinary soils these two timbers may last ten or even twelve years by careful selection, and timber that has been rung, say, twelve months will very likely last longer than if put in the ground when green and very sappy. Some farmers of long experience in the district say that White Gum will last longer if not charred, although in most timbers charring is considered as a preservative for the portion put into the ground. It would be advisable only to use this timber in temporary and unimportant fences.

For boundary fences, and for cultivation paddocks, it is better to use only reliable timbers, even at twice the cost, and put up a good substantial close fence that will not require continuous patching after a few years; something that will ensure the safety of your crops, keep your stock on your own land and your neighbours' off. Yellow Jacket Box may be classed as the most durable of all, and certainly is the best for strainers, or any other round posts. Red Gum is also very good for these purposes. Ironbark is also very useful for general purposes; but the timber most generally used, and also very reliable, is Red Stringybark, a fine, straight-grained, good splitting wood, the best to work of them all, and is also durable. There are varieties of the Stringybark, however, which should be avoided, generally known as White Stringy; these are short-grained sorts, and quite unfit to put into a good fence. With respect to wooden droppers or battens, used between the posts in many cases in preference to iron

droppers, are generally to be recommended, Red Stringybark makes by far the best and neatest of any timber. The battens should rest or be put a few inches into the ground, so as not to be a weight on the fence, but rather a support to it; it is better to tie these to both top and bottom wire to keep them in their places.

Strainer posts should be put into the ground at least 3 ft. 6 in., and split posts 2 feet. Six wires at least should be used for sheep and cattle fence; seven wires, better still. Posts should be not more than 12 feet apart in boundary fence, with one or two battens between each post. Strainer posts should not be more than 100 yards apart. All posts should be well rammed at the bottom. A good size for strainer posts is 1 foot in diameter, and for split posts 8 in. x 4 in., with a face of not less than 4 inches. Galvanized wire, although somewhat dearer than black wire, will last very much longer, as the latter is so susceptible to rust.

Clearing land fit for the plough.—In grubbing timber it is better to have the roots run and taken out to a depth of at least 8 inches from surface of the ground, and for land intended for an orchard to twice that depth. This will save a lot of time and extra labour when the first ploughing is in progress. If a Forest Devil be used, it is better to cut the top roots, and run them at once. Although some trees may be pulled down without cutting a root, it will be found more awkward in running the roots afterwards than taking the top roots out neatly in the first instance; the latter is the cleaner and better way, especially in green timber.

In clearing White Gum country some of the lighter limbs may be burned if well packed, but it is no use trying to burn the large butts in any ordinary fire; better to get sufficient strength—bullocks preferred—and draw them off the land intended to be cultivated at once.

Stump-holes should be filled in as soon as possible, to prevent the earth taken out from getting consolidated, and do not put roots back in the holes, or they will give trouble later on.

Ploughing in the strong heavy soils of New England, especially the first time, is very heavy work indeed. Strong horses, strong ploughs, and strong harness should be purchased; light horses are no good for cultivating the soils up here; get them strong and stanch, or regrets will be sure to follow.

New ground, after being ploughed once, should always be left for a few months to sweeten and for decomposition of grass-roots. Liming will greatly assist in these processes, besides helping to liberate plant food for the crops when sown. A second ploughing should always take place the first year, and, in fact, every year if the best results are to be obtained; also, plenty of harrowing and cultivating should be indulged in. Properly cultivated land will always return good interest on the time and money expended.

Draining.—In New England the rain that falls on the land is generally quite sufficient for its requirements, without water from higher ground being allowed to run on to it; it is, therefore, better to

put drains to carry water round the paddocks, and prevent this. In many cases good drains through them are required as well; badly drained land will not produce crops equal to well drained lands even in dry seasons, and it is noticeable that swamp-lands in dry weather, after water has dried off them, cake and crack the worst of all, and they are invariably sour. Draining in New England is very important. With a quarter-yard earth-scoop, and a couple of good horses, good drains can be excavated at a minimum cost.

In concluding these few remarks on starting a small farm in this district, I trust they may be of benefit to some, as they are the results of actual experience here.

MR. R. L. DAWSON writes, *re* BUILDING IN PISÉ:—

REFERRING to an article on this subject in the *Gazette* of 3rd April, it might be interesting to note the effect of an experiment in this class of wall building carried out by my father, the late R. B. Dawson, at Bentley, near Casino, Richmond River, so long ago as 1871.

The wall, about 24 feet long, with short wings at either end, was built of a stiff reddish soil, mixed and rammed in wooden frames exactly as described in your article, and was carried to a height of between 6 and 7 feet, the thickness being about 14 inches. It formed the back of an open bark-roofed, lean-to shed, and in spite of considerable exposure to the weather, stood remarkably well for many years, until a mason bee, or fly, bored into it and gradually damaged it so much that it began to crumble and fritter away. A coating of plaster or cement would probably have protected it from these pests, and in humid climates like the Richmond something of the kind would certainly be necessary.

My father had an idea of building a pisé cottage, and indeed started one on sandstone foundations, but found the work so ruinously expensive that he had to abandon the project. Wages were high in those days, and so were the ironwork and timber for the frames, and the work itself is slow and has to be so carefully done to be a success that I doubt if buildings of this description are practicable to men of moderate means, except in countries such as India, where cheap labour and plenty of it can be obtained.

Wheat-Grain Germination Experiment.

R. W. PEACOCK.

OWING to the varied conditions under which wheat-farming is practised throughout this State, it is important that a better knowledge should exist of the various questions treated in the following experiment. They, being the effect of chemical fertilisers when applied with the grain, the action of the treatment with bluestone for bunt, and the question of sprouting of the grain when sown under conditions unfavourable for its immediate germination.

The present experiment does not pretend to elucidate these vexed problems, but simply opens up a field for further investigation of a more exhaustive character, and, in some respects, throws no small amount of light upon many phases which are not generally understood.

The conditions under which the germination took place unavoidably differed from those obtaining when wheat is sown in the field. The method followed was that of placing each set of grains upon separate woollen cloths, which were kept moist by frequent applications of *tepid* water.

This method has many disadvantages, especially as regards the observation of the action of the various chemicals upon the rootlets, which soon become embedded in the material, and the weakening of the various solutions by leaching through the application of large quantities of water throughout the experiment.

The chemical manures used on Nos. 1, 2, 3, 4, and 5 were applied in excess of the quantities used in ordinary wheat culture.

Nos. 6 and 7 were bluestoned with a solution of 1 to 50 strength, or in the proportion of 1 lb. of bluestone to 5 gallons of water, and this solution would be considerably weakened by the application of water throughout the experiment. Nos. 8 and 9 were not treated, and were used as checks upon the others.

No. 10 was infected heavily with bunt spores, which evidently had no deleterious effect upon the germination, and can also be used as a check.

Nos. 11, 12, and 13 proved the most interesting of the series. They represent grains which had, owing to rains during harvest time, commenced to grow in the field, and had afterwards been threshed.

The grains of No. 11 were those which had only just shot, the epidermis of the grain having broken.

The grains of No. 12 had been well shot, and in this respect were greatly in advance of No. 11.

Those of No. 13 possessed withered shoots and rootlets fully ¼ of an inch in length, and were not placed on trial until four days after the others.

The grains of Nos. 11 and 12 commenced to grow almost immediately upon being moistened, and many had grown 3 inches before the check grains had reached 1 inch.

The first two germination columns represent the percentages germinated the third and sixth days after the commencement.

The other columns represent the progress for the remainder of the experiment, the grains being taken off after shooting to the standard of 1 inch in length.

At the termination of the experiment several grains were alive, and had not reached the standard, others were apparently perfect, and probably would have germinated if left longer.

The dead grains were mostly attacked by moulds, as also were a few of the rootlets of the live ones, the following being the results:—

It would appear from this that there is a possibility of the direct application of these fertilisers interfering with the germination of the grain, the extent of this injury may be to some extent mitigated by the counteracting influences of the soil.

Regarding the action of bluestoning from these results, and also from other experiments I have carried out in the same direction, I am of the opinion that germination is considerably retarded by a solution of the strength used, and other experiments are in progress to demonstrate the most desirable strengths to use to ensure immunity from bunt without affecting the germination.

The results also tend to prove that sprouted grains retain sufficient vitality for several months to ensure their reproduction under favourable conditions.

I was led to this experiment by my experiences at the Coolabah Farm. Upon one occasion the wheat had been sown before rain fell; shortly afterwards a light fall resulted in large portions of the drills appearing well above ground, leaving portions completely bare. A further fall of rain in six weeks' time resulted in the appearance of the remainder of the drills in which apparently a large percentage had germinated. It was reasonable to suppose that the wheat which appeared later had sprouted previously, owing to the rains which brought the first portion of the crop up.

To test this supposition I germinated grains, allowing them to produce shoots up to an inch long, and afterwards dried them off and kept them in a dry place for three months, at the end of which time a large proportion were resuscitated, and produced shoots varying in vigour in proportion to the lengths of their original shoots.

The present experiment bears out these results, and the impaired vitality was very noticeable in those grains which had been well sprouted previously. It would, therefore, be possible to obtain a crop from seed which had sprouted previously.

It also explains how seed has often retained its vitality after such was considered impossible. It would, nevertheless, be unwise to depend upon sprouted seed to make a crop, or to take too great a risk in the hope that seed which has been in the ground for a considerable time will eventually germinate.

Germination Experiment.

Date.	No. of Grains.	No of Exp.	Treatment	Percentage Germinated.	Percentage Germinated	Grains taken off after Producing Shoots 1 in. in length											Shot Grains taken off.	Dead Grains.	Total.
				15/5/03	18/5/03	19/5/03	20/5/03	21/5/03	22/5/03	23/5/03	25/5/03	26/5/03	27/5/03	29/5/03	30/5/03	1/6/03	4/6/03	4/6/03	
				per cent.	per cent.														
12 May	100	1	Sulph. ammonia	69	77	19	30	11	8	2	3	3	2	4	0	0	1	17	100
12 ,,	100	2	Nitrate of soda	60	80	2	40	18	9	1	5	3	1	2	0	1	3	15	100
12 ,,	100	3	Superphosphate	30	45	4	14	10	3	0	3	3	2	3	0	3	4	51	100
12 ,,	100	4	Sulphate of potash	59	78	7	35	24	9	3	2	2	1	3	0	0	2	12	100
12 ,,	100	5	Complete manure	69	78	62	7	3	3	0	1	0	1	2	2	0	3	16	100
12 ,,	100	6	Bluestoned, 1 to 50 solution.	51	72	7	22	19	17	2	4	3	1	4	2	5	9	5	*100
12 ,,	100	7	Bluestoned, 1 to 50 solution.	68	81	3	9	24	19	1	13	5	6	12	2	2	2	2	100
12 ,,	100	8	Not treated	97	97	67	19	4	2	1	1	0	0	0	1	0	2	3	†100
12 ,,	100	9	,, ,, ..	99	99	53	36	6	0	2	0	0	0	0	0	0	1	2	‡100
12 ,,	100	10	Infected with bunt	99	99	77	18	0	0	1	0	0	0	0	1	0	2	1	100
12 ,,	100	11	Grain just shot in field at harvest time	99	99	69	4	1	3	2	0	0	1	2	1	0	0	17	§100
12 ,,	100	12	Grain well shot at harvest time	82	82	53	6	5	2	1	0	0	1	1	1	0	0	30	‖100
16 ,,	100	13	Grain very much shot ..	...	...	.		.	.	Grains shot at 34		..	8	19	5	2	2	64	100

* 1 grain classed as dead apparently perfect. † 2 grains classed as dead apparently perfect. ‡ 1 grain classed as dead; shoot had died back.

§ 16 grains died back after shooting; many shoots 3 in. long on 19th. ‖ 14 grains died back after shooting: many shoots 3 in. on 19th.

The Apple

[Continued from page 530.]

W. J. ALLEN.

Gathering and Storing Fruit.

The fruit is in a fit state to pick as soon as the seeds are well coloured, at which time it is well developed and coloured. If picked before, the chances are that the fruit will shrivel if kept for any length of time.

From recent tests in cool storage in America, it has been found that apples keep best in cold storage at a temperature of 31 deg. to 32 deg. F., which retards the ripening process more than does a higher temperature.

If apples are to be stored any length of time they should be packed in close packages, which are better if lined with paper. High-grade fruit it would be best to wrap in paper. Apples which are to be kept in cold storage should be picked carefully to avoid any bruising, and if the weather is warm should be stored as soon as possible after picking.

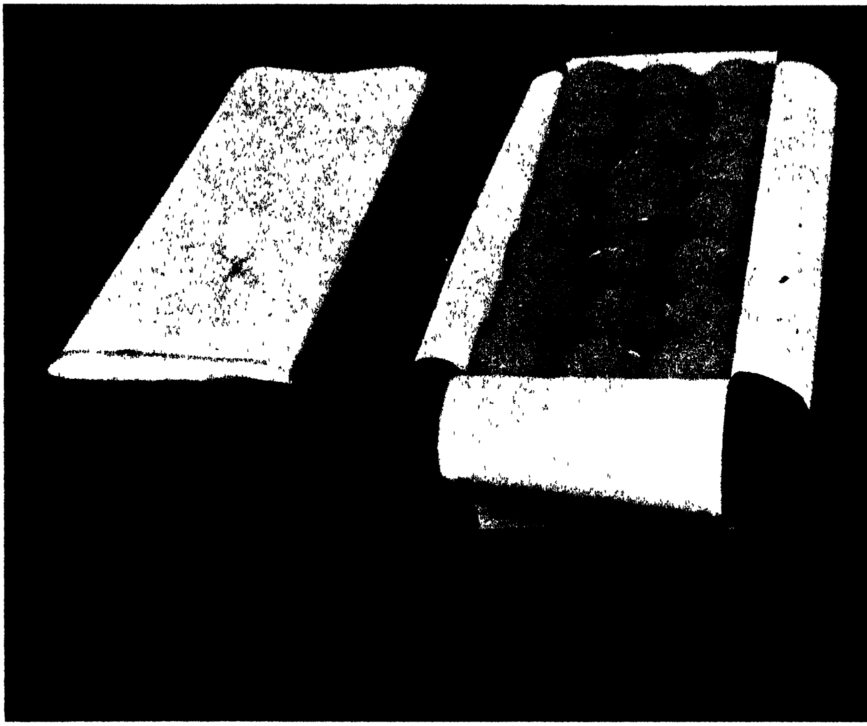
If fruit is intended to be held by the grower in his own store-room, it would be best to pick it when cool, and store it away in cases well lined with paper, opening the room by night and closing it in the daytime so as to keep the temperature as low as possible, otherwise the fruit will become soft and useless. In some of our cooler districts I have seen it keep well in cases underneath the tree as well as in enclosures.

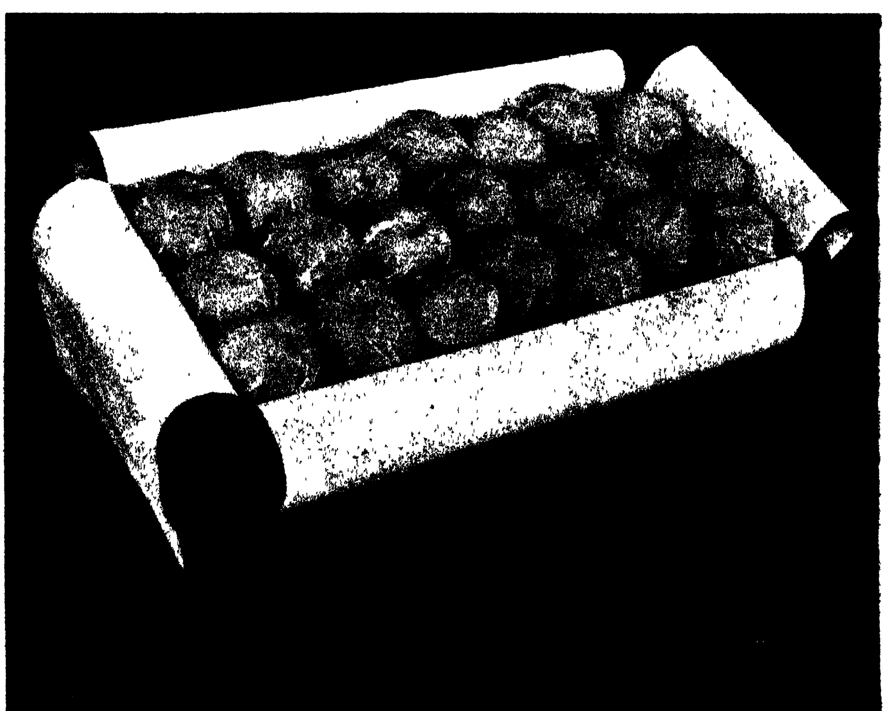
Marketing.

The apples should be nicely graded as to size and colour, and packed in clean cases. If the fruit is intended for export, it is best to wrap it, using a good quality of paper for the purpose. For local trade the merchants are not particular as to whether the fruit is wrapped or not. Wood wool is a good thing to use at both top and bottom of box to protect the top and bottom layers. We have used paper shavings, but they are not to be recommended, as they are not so good as the wood wool, and give the cases an untidy appearance.

Cultivation of the Orchard.

This matter should receive the careful attention of the orchardist from the time the tree is planted for at least six or seven months out of every year. In the spring, the orchard should receive a thorough ploughing; after which time the cultivator should be kept going in order to prevent the appearance of weeds, and also to keep the surface soil finely worked up to a depth of at least 6 inches. The loose soil acts as a mulch, and assists in retaining the moisture, which in many parts of this State is so badly





Apples packed for Export.

required during the summer months. During the late fall and winter months the orchard may be allowed to rest and grow weeds (provided peas or tares have not been sown in the orchard in March), which may be turned under at time of spring ploughing. As soon as possible after each rain as the land is dry enough, it should be stirred up before becoming baked, in order to prevent the evaporation of the moisture which has fallen and the ground becoming dry and hard. In places where irrigation is practised the application of water should never be deferred until the trees show signs of distress, but water should be applied whenever the soil begins to become at all dry, else the application of water may have a tendency to cause the fruit to drop.

Manuring.

One frequently hears the remark from old growers that they never now get the crops which they used to get years ago. We must not forget that trees often become weak and exhausted from the heavy loads of fruit which they carry, and we cannot expect them to continue cropping well unless we feed them. This neglect no doubt is very often the solution of the question, why trees do not thrive, and carry as good crops as in former years. As a matter of fact, there are not a few growers who expect their trees to do well without either cultivation or manuring, and, to add further insult to injury, expect them to feed the cows, sheep, and pigs on the grass found growing under them as well.

At our Government orchards we have found a dressing of stable manure applied to any weak tree during the first few years after planting to be a great help, and later on peas or tares are sown in March, and the crop ploughed under the following spring. This has kept these young trees bearing regular crops of fruit and the trees in splendid growing condition, as will be seen on reference to figures showing the different types of trees from which we have been taking good crops of fruit, and which are not heavily laden in our Bathurst orchard. (Illustration will appear next month.)

In sowing either peas or tares a small quantity of commercial fertiliser is used in order to give them a start. It will be found that the poorer the soil the more of the latter will be required if a good crop of green manure is to be expected. I feel sure that with a little care, and by growing a few crops for green manuring, there are many poor pieces of soil which could be made to produce profitable crops again.

Mr. F. B. Guthrie, Chemist to the Department, in his pamphlet on the preparation of different fertilisers, gives the following mixture for apple-trees, viz.:—

Bone-dust	520 lb.
Superphosphates	300 „
Sulphate of potash	300 „
	1,120 lb.

This mixture contains of nitrogen = 2 per cent.
phosphoric acid = 15½ per cent. being water soluble.
potash = 15½ per cent.

For young trees apply 4 lb. to the tree—a higher rate if the trees are older. The above quantity of nitrogen should be sufficient if the trees show a want of nitrogen. If they are not of a healthy green, sulphate of ammonia should be applied at the rate of 1 lb. per tree as a top-dressing, mixed with dry loam.

About 400 lb. of raw bone-meal and kainit in equal proportions has also been found a good dressing.

Soil which is deficient in humus and generally out of condition always hardens, and does not become loose and mellow as does land which is manured properly, nor will it hold the moisture as will properly cared-for land.

Insect and Fungus Diseases of the Apple most common in this State.

American Blight or Woolly Aphis.

This pest will live on certain varieties of trees, and if allowed to go unmolested it soon spreads over trees subject to its attacks, and causes the twigs and branches of the tree to become lumpy and distorted, and these in their turn make fairly good breeding-grounds for the codlin moth.

Treatment.—In planting out a young orchard be sure to use only blight-proof stocks. Then, if the trees are watched closely, there is very little trouble in keeping this pest out of even the most susceptible varieties. A little oil (either kerosene or Vacuum Oil Co's. red oil) painted over any portion of a twig affected will soon eradicate it. Spraying with resin and soda several times each summer will keep it pretty well under if it has secured a footing in the orchard.

(*a*) *Resin and Soda Wash.*—Dissolve 3 lb. of washing soda and 4 lb. of resin over a fire in about 5 pints of water; then add water to make 5 gallons; boil well till the resin is thoroughly dissolved, and the mixture is of a dark-brown colour, and then take 1 gallon of the mixture to 7 gallons of water and apply milk-warm.

To demonstrate that this pest can easily be kept in check, I may say that in our Departmental orchards we have hundreds of varieties of apples on which it would be if it were allowed to attack same, but without any apparent trouble we have kept this pest away, and it is impossible to find a single lump on any of our trees caused by this insect, nor can woolly aphis be found on any of our trees.

San José Scale.

This scale is becoming pretty well known, and although it has caused some loss in a few orchards it has never done the same amount of damage here as in America, and the lime, sulphur, and salt mixture with which most of our growers spray their trees every winter has kept it well under. The resin and soda wash applied in the summer when the larvæ are moving in January and February will also destroy them when properly applied.

Mussell Scale.

This is rather a common pest in the apple orchards and is easily detected on the trees.

Treatment.—Lime, sulphur, and salt, applied in the winter; or resin, soda, and fish oil or kerosene emulsion in the summer, when the insect is hatching.

Lime, Salt, and Sulphur Wash: Winter Wash for Deciduous Trees.

Directions for making Lime, Sulphur, and Salt Wash.

Formula :—	Lime	30 lb. (fresh slacked)
	Sulphur	20 lb.
	Salt	15 lb.
	Water	60 gallons.

Take 10 lb. of lime and 20 lb. of sulphur, and boil them until thoroughly dissolved; then add the rest of the lime and the salt and water to make 60 gallons. Strain and spray when rather more than milk warm.

The only difficulty likely to be experienced in making up this mixture is in getting the sulphur thoroughly incorporated. To do this requires continuous boiling, with constant stirring, until the liquid is of a deep yellow colour. If it is feasible, the sulphur should be first ground up with a small quantity of water into a paste, in the same way that mustard is made, so that the grains of sulphur may be thoroughly wetted. This will greatly hasten the process, and if as much as 20 lb. of sulphur is to be used, this may be ground up a little at a time in a largish mortar and added to boiling solution.

The best thing to use for boiling this mixture in is an enamelled vessel. If only a small quantity is made at a time, an ordinary enamelled preserving pan is the very best kind of vessel. In the absence of these, an iron vessel or an ordinary oil drum may be used. **On no account use copper vessels.**

The actual manner in which the ingredients are added does not matter. It will be found best to slack the lime on a board in preference to slacking it in the vessels. Hot water is not necessary for slacking it.

The main point is that the lime and sulphur should be well mixed and thoroughly boiled together.

The action of this spray is to smother and destroy the scale and eggs. Some people scrub the bark of the trunk and main branch with a brush before spraying them with this wash.

Resin Wash for Scale Insects on Citrus Trees.

Special Resin Wash for Citrus Trees.

Formula :—	Caustic soda, 70 per cent.	6 lb.
	Resin	16 lb.
	Fish oil	3 pints.

Boil 10 gallons of water and add the above, boiling the whole together from two to three hours, or until well dissolved. Keep well stirred. Add hot water, a little occasionally, until there is not less than 20 gallons of hot

solution. Dilute in the proportion of 4 gallons of hot water to 1 gallon of the hot solution, so as to bring the whole up to 100 gallons. Never add cold water when cooking. This is the best spray I know of for scale on citrus trees.

The solution should be kept as hot as the hose can possibly stand without damage. As it comes in contact with the air in the form of spray, the mixture will be cooled to such an extent that no harm will be done to the tree; and it has been proved that a warm spray is far more effective than a cold one.

In spraying, see that the work is thoroughly done, care being taken to reach the inside of the tree as well as the outside, and the under as well as the upper sides of the leaves.

Codlin Moth.

This is the worst foe of the apple-grower, and gives more work to those who try to keep it in check than most of the other pests combined. It appears to be more prolific in this State than in Tasmania, and in consequence is much harder to keep under, especially as there are so many orchardists who do not disturb themselves to fight it, making use of the pretext that there is no use in their doing so until Parliament passes an Act compelling every grower of one or more trees to spray, bandage, and pick up all moth-infested fruit, and treat the latter in such a manner as will destroy all grubs. Most of our apple-growers are in favour of such a Bill, I believe.

At our Bathurst orchard last year, we used the arsenite of soda and several other mixtures for combating the codlin moth, with excellent results, and had the satisfaction of picking at least 90 per cent. of clean fruit. The sprayings should be given—one as soon as the petals have fallen; again in three weeks' time; followed by one or two further sprayings at intervals of from three to four weeks. Put on the bandages about the time the first spraying is given, and pick from the tree and ground and destroy all moth-infested fruit. I have found that there is a natural enemy of the moth this year in many districts, which is destroying a good many of the grubs underneath the bandages.

Treatment.

Spray with arsenite of soda, prepared as follows:—1 lb. of best arsenic and 2 lb. of washing soda boiled in 1 gallon of water for about three quarters of an hour, or until the mixture is quite clear; then add 1 pint of the stock solution to 40 gallons of water, to which has already been added from 6 to 8 lb. of best freshly slacked lime. If this latter precaution is neglected, the result will be that the spray will seriously burn the foliage. Some varieties of apple-trees are much more tender than others; for these, use the larger quantity of lime. The arsenic is much cheaper than Paris green, and when bought in quantities should not cost more than about one-third as much per lb. For this State, I am of opinion that at least four sprayings will be necessary to keep the moth in check.

Fungus Diseases of the Apple.

Bitter Pit.

Some of our best apples are attacked by this trouble, and during the past three years we have been carefully watching this disease at our Bathurst orchard, and have found that under certain conditions the fruit does not develop the disease as readily as under others. In this orchard we have eight Cleopatra apple-trees, which for the past three years have been left unpruned. Naturally they do not put on as much growth as the pruned trees of the same variety, and as the branches are not strong the weight of the fruit bends the limbs out in all directions, thus opening them up and allowing the light and sun to circulate freely around all the apples. These trees were sprayed with Bordeaux mixture, and were in every other way given the same treatment as the adjoining pruned trees; but an investigation disclosed the fact that they were remarkably free from this disease, while the adjoining pruned trees showed fruit more or less affected—the worst of which had possibly 8 per cent. while a few did not show more than 3 per cent. On the unpruned trees it was hard to find, if any, more than an odd specimen so affected. These trees all received one dressing of Bordeaux mixture, and a winter spraying with lime, sulphur, and salt, and just before ripening they were sprayed with ammonio-carbonate of copper.

Bordeaux Mixture for Fungus Diseases.

Directions for Preparing Bordeaux Mixture.

Formula:—Copper Sulphate (bluestone)... ... 6 lb.
Lime ... ... 4 lb.

made up with 22 or 45 gallons of water, according to the season, the smaller proportion being the winter dressing.

Copper Solution.

It is immaterial whether hot or cold water is used to dissolve the bluestone. If the mixture is to be made in a hurry, it is best to boil the copper sulphate in water. If there is plenty of time, use cold water; but in this case the bluestone must be suspended in a porous bag (bit of muslin or sacking) as near the surface of the water as possible. If the copper salt is thrown into the vessel, and water poured on the top of it, it will not dissolve in a week. When suspended as described, it should dissolve in about twenty-four hours.

The sulphate of copper solution when made must be diluted largely before the lime solution is added to it. This is a very important point. If the copper solution is too strong, the precipitate formed is thick and heavy, and liable to clog the nozzle of the spray pump. If the copper solution is made by dissolving the bluestone in a small quantity of hot water, it should be diluted to 20 gallons before adding the lime.

Lime.

The lime, which should be freshly burnt, is slacked with a small quantity of water. Slacking on a board is to be recommended rather than in a cask, because if the lime is really freshly burnt, there will be considerable heat evolved, and the barrel may suffer. Place the whole of the lime on a board, and pour over it about 3 or 4 pints water. The lime, if it is good, should become very hot, crack asunder, give off a quantity of steam, and finally crumble into a fine, white powder. This is now emptied into a barrel and water added. It is not an easy matter to make the whole of the lime into a wash. It cannot be done by simply stirring about with a stick. The best way is to use a shallow tub, so that the lime may be pounded up with the water, all the lumps being broken up. Allow to settle, and pour off the milky solution through a strainer if any lumps are present (into the copper sulphate if you like, or into another barrel), and add more water, repeating the poundings until all lumps have disappeared.

Mixing.

The mixture must be made by pouring the lime-water into the copper solution, and not by adding the copper solution to the lime-water.

The proportions of the Ingredients.

The proportions above given provide ample lime to more than neutralise all the copper sulphate; in fact, there is more than twice the quantity required to convert the copper into the hydrate, provided, firstly, that the lime is pure; secondly, that it is freshly burnt; and thirdly, that the lime is really all made into wash.

With regard to the latter point, instructions have never been given, and in many cases not more than a quarter or half the quantity of lime recommended becomes finally combined with the copper.

If, in addition to this, the lime is not pure, and has been burnt some time before being used, it may quite easily happen that, instead of the above quantity of lime being in excess of what is required, they may be altogether insufficient for the purpose, and that the solution may contain free copper sulphate. Assuming that free copper sulphate, even in small quantities, does "burn" the foliage, and that it is undesirable to have any in the mixture on this account, it appears preferable to have no fixed quantity of lime, but simply to have a definite quantity of copper, and to add the lime until the copper is neutralised. This is the plan recommended in the latest Bulletins of the United States Departmsnt, and is described in detail by Dr. Cobb in the *Agricultural Gazette*, April, 1897.

In order to know when the copper sulphate is destroyed, the readiest test is ferrocyanide of potassium; but it is important to remember that at a certain point ferrocyanide ceases to give the characteristic colouration (in such a solution as we are dealing with), although there is still unaltered copper sulphate in solution. In other words, the solution may contain free sulphate of copper, although the ferrocyanide test, applied as directed, does not show it.

Therefore it is important to remember that the mixture is not ready for use when ferrocyanide no longer gives a red colour, but that a quantity more lime (even half as much again) must be added.

Instead of ferrocyanide, a rough test to show when sufficient lime has been added, consists in placing a clean knife-blade in the mixture for a few minutes. If there is no red stain on the knife-blade, the copper solution is neutralised. When this point is reached, add more lime.

Vessels employed.

For the copper solution wooden vessels are preferable, though copper vessels may be used. Iron vessels should be avoided. For the lime, wooden tubs or barrels. Do not leave the mixture in the spray-pump, as it will slowly attack the copper; but when the spraying is finished, pour it away, and wash the pump and hose well with water.

Purity of Ingredients.

Samples of "bluestone" are often received which contain a quantity of sulphate of iron. This adulteration can only be effected by dissolving copper sulphate and sulphate of iron, mixing the solutions and allowing them to crystallise out. Such a method is much too elaborate to be carried out on a small scale, and there must be more of the stuff about. The following hints will enable anyone to suspect such a compound. Bluestone should be in the form of dark-blue crystals (the adulterated mixture referred to is light-blue, like sulphate of iron). They dissolve completely in water—readily and completely in hot water, or water to which any acid is added.

In order to test its purity still further, add ammonia. A pale-blue precipitate is formed, which dissolves to an intense blue colour. This solution should be perfectly clear, and leave no sediment on standing. If a reddish sediment settles, it is due to the presence of iron.

Lime.—The best freshly-burnt stone lime only should be used. To test it, place a few lumps in a small heap and sprinkle with water. The water should be absorbed by the lime, which gradually falls to pieces, becoming very hot in the process, and giving off a quantity of steam. It gradually crumbles to a fine, white powder. If it does not get hot enough to give off steam, it has not been freshly burnt.

The addition of molasses has been found advantageous in the preparation of Bordeaux mixture. Molasses helps the mixture to stick to the foliage, and its addition helps the lime to dissolve, so that it is easier to get a proper solution which will not choke the nozzles.

If molasses is used the proportion will be—

Bluestone	6 lb.
Lime	4 lb.
Molasses	4 quarts.

made up to 22 (for winter) or 40 gallons (for summer) with water.

Apple Scab.

In some districts, where there is much damp weather about the time when the fruit is setting and the following month, this disease does considerable damage to both leaves and fruit, affecting some varieties more than others. Scab is easily recognised, forming dark or black coloured scabs of various sizes, which soon spoil the look of the apple when growing, and cause an immense number to fall.

Treatment.—If the trees are not sprayed in the winter with lime, sulphur, and salt, they should have a good application of Bordeaux mixture (winter strength), just as the buds are bursting, another application as soon as the fruit is set, followed by another about a fortnight later. This should pretty well check the disease, excepting in very wet weather, when it may be found necessary to give a further application. Practically the same treatment is required for Powdery Mildew, Ripe Rot, and Bitter Pit.

Late Stages of Fungus Diseases.

Directions for making Ammonio-carbonate of Copper.

Formula :—	Copper carbonate	5 oz.
	Ammonia (strong, ·84)	3 pints.
	Water...	45 gallons.

Make a paste in a wooden bucket of the carbonate of copper and a little water. Add the ammonia, which will dissolve the paste, and then dilute to 45 gallons.

The first application should be made long before the leaves are half grown.

Powdery Mildew belongs to the *Erysiphea* group, and its *mycelium* spreads itself over the surface of the attacked organ, and resembles the oïdium of the vine, which also belongs to the same group. On this account, sulphur dusted on the plants in fine powder, which has been found so effective against oïdium, is equally effective against powdery mildew.

(*To be continued.*)

Candied Lemon Peel.

S. A. HOGG,
Orchardist, Experimental Farm, Wagga.

THE following is the Italian process, obtained by the Agricultural Department of New South Wales at some expense, augmented by the necessary accessories and explanations :—

Plant required to handle from 1 to 2 tons of Lemons.

5 wine casks. (30 gallons capacity.)
2 dozen 4-gallon stone jars.
4 knives. (For halving the lemons.)
4 pitting spoons. (For removing the pulp.)
1 tin-lined copper or enamelled vessel. (30 gallons capacity.)
1 brass sieve. (For removing peel from cask.)
1 perforated ladle. (For skimming syrup.)
1 cwt. salt. (Coarse but soluble.)
15 cwt. sugar. (Any good brand of granulated.)
1 saccharometer. (Beaumé.)
2 large enamelled buckets.
6 draining trays.
1 syrup table.

This completes the outfit, taking for granted an ample supply of fuel and water.

Draining Trays.

These may be constructed of light wood to any required measurement. A convenient size is a frame 3 ft. in length by 2 ft. 2 in. in width by ½ inch in depth. To the bottom of these frames may be nailed or screwed ½ inch by ¼ inch battens, leaving ¼-inch spacings. The whole to be supported lengthways by two pieces of 1 inch by ½ inch let into the frame 1 foot apart.

Syrup Tables.

This should be really termed a trough. It has a depth of 6 inches, and is so built that the draining trays fit inside it.

The trough is tin-lined, with a drain-cock in one corner. The whole is then given a pitch, so as to facilitate the drawing off of the syrup.

Selection of Fruit.

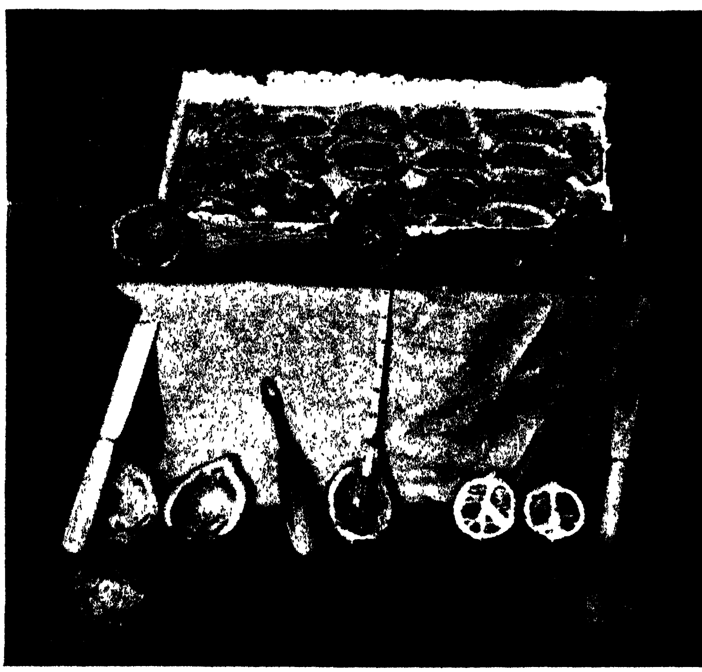
The early and mid-season lemons contain more of the essential oils than those later in the season; consequently, by adopting the former a better-flavoured article may be produced. The question of colour plays an important part, so it will be desirable to consider it. The lemons may be picked in

three stages (providing that they have matured as to size), viz., dark green, green and yellow, and bright yellow. As to the texture of the skin, this also may be divided into three grades, viz., rough, wrinkled, and smooth; and the size into small, medium, and large.

Grading.

This is a very important factor, as the following difference in prices is most apparent.

For instance: There is 1d. per lb. in favour of the smooth yellow as compared with the wrinkled yellow, ½d. between the yellow and the dark, and ½d. between the dark smooth and the dark wrinkled. The grading may be carried on at the time of picking. An easy method of gauging the size of the lemons is by passing them through rings of the required dimensions before placing them in the picking-boxes. It is desirable to handle the fruit with all expedition; the sooner it is placed in the pickle the more flavour will be retained.



Candied Peel.
Showing packed box, saccharometer, pitting spoon, cut fruit, and knives.

Selection of Grade.

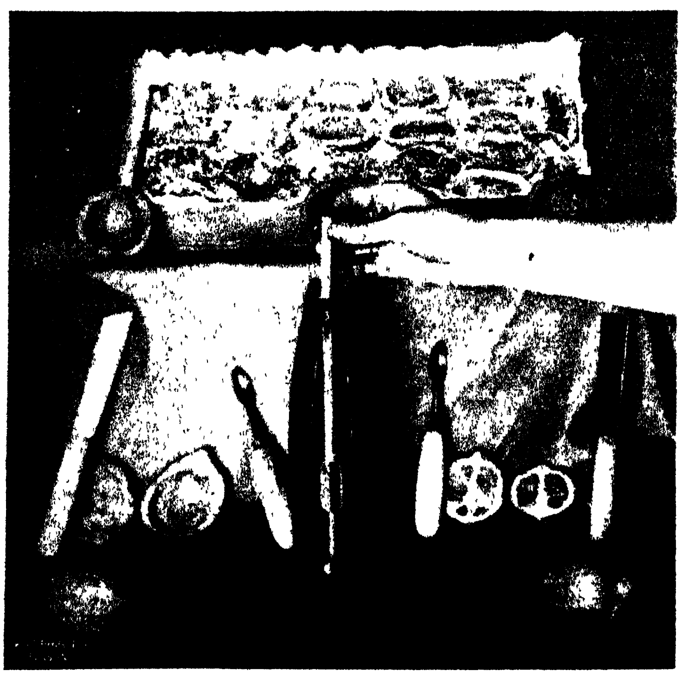
As to the standard or first grade, select a bright, yellow-skinned, even-surfaced, medium-sized lemon. (The question of thickness of skin does not seem to be of great consequence.)

For the second grade, yellow and wrinkled.
,, third ,, smooth dark.
,, fourth ,, rough dark.

Pickling.

Take a cask of, say, 30 gallons capacity; clean with steam, or soda and boiling water. Remove the lid, and pour into it 20 gallons of clean fresh water, and for every gallon of water add and dissolve $1\frac{1}{2}$ lb. salt. This should read by Beaumé saccharometer 10° density. (Sea-water, if convenient, may be used.)

The lemons are now cut longitudinally (this may be a matter of choice, but the appearance is certainly in favour of it), and the pulp removed by aid of a pitting-spoon. (The spoon is shown in the illustration, standing next to the saccharometer. The spoons are cheap, and may be obtained in Sydney.) The peel is immediately placed in the brine until the cask is full, taking care that it is always submerged. The lid of the cask may be placed upon the surface, and weighted down with bricks or stones. (As a word of precaution, take extreme care not to use at any time iron weights or vessels of iron, as the slightest contact of the peel with iron stains and turns the former black.)



Candied Peel.
Showing saccharometer inserted in bottle with neck broken.

The peel remains in this brine for at least eight days, from whence it is removed, drained, and placed in a cask containing fresh water for two days longer.

It will be found upon examining the peel before placing it in fresh water that the brine has acted upon any remaining pulp within the cups, causing it to be soft and pulpy. This can easily be removed with the thumb before placing it in the fresh soak.

The same precaution must be adopted in the fresh water with regard to keeping the peel below the surface. At the expiration of two days the fruit is removed, and placed in the cooking kettle, containing cold fresh water, which is raised to boiling point, and the whole boiled for five minutes. From this they are taken and washed in cold fresh water, to be immediately spread on draining trays, the cups being turned downwards. This is merely to drain off the water and any superfluous moisture; half-an-hour is generally sufficient. They may be placed in the sun if the weather is cool, as shown below. When sufficiently dry, the peel is placed in stone jars or wooden casks, containing cold syrup at a density of 32° Beaumé. There it remains for three days. By this time the peel will have absorbed much of the sugar from the syrup, thereby lessening the density, which must be kept up to

Candied Peel.
Exposed on trays to dry.

32°; so the syrup is drained off, and the peel placed in another jar of cold syrup—density 32°—for another period of three days, ultimately being removed and drained upon the syrup table. It is now dried in the shade, or in an evaporator, at a temperature not exceeding 100° Fahr. When the peel feels just a little moist to the touch, it is sprinkled with granulated sugar, and allowed to stand a few days before packing in boxes for the market. The resultant weight is about two-thirds of the original lemons before removing the pulp.

To make the Syrup.

Take 140 lb. of sugar and 11 gallons of water, place in the cooking kettle and gradually warm. When the sugar is all dissolved bring to the boil, taking care to skim the surface, removing the froth and any dirt. It will be found by the time the syrup has been reduced by one-fifth that the required density will have been arrived at. Now test with saccharometer, allowing

3° for the hot syrup. For instance, if the hot syrup denotes 29° Beaumé, *when cold* it will read about 32°. To every 5 gallons of syrup dissolve and *add 1 oz. of gum arabic.* This syrup should not be used until the next day, so it is advisable to have a stock of cold syrup. As was previously pointed out, the syrup loses its density, caused by the peel absorbing the sugar, and in return giving off its moisture, thereby reducing the density of the syrup. The required density is regained by boiling; and when arrived at the syrup is allowed to cool, and used for a second batch of peel. This practice may be repeated until practically all the sugar in the syrup is absorbed by the peel.

As shown in the illustration, a long-necked bottle with the head broken off may be used as a makeshift for testing the density of the syrup.

Packing.

The peel is packed in 7-lb. boxes, the boxes being lined with white paper, and the fruit neatly packed in layers. The box is constructed of light pine, sides, bottom, and top $\frac{3}{16}$ in., ends $\frac{1}{2}$ in. The inside measurement is 1 ft. $\frac{3}{4}$ in. x $6\frac{5}{8}$ in. x $4\frac{1}{8}$ in.

Cost.

In handling only a small quantity the cost is comparatively much heavier than when a large bulk is treated, and many things must be taken into consideration, such as price of sugar, labour, etc. But as accurately as may be arrived at after handling only a small lot, the price estimated for sugar alone would be from 1d. to $1\frac{1}{2}$d. per lb. The first grade lemon peel brings on the market from $5\frac{1}{2}$d. to 6d. per lb.

Report on the "Rodier" System of Rabbit Destruction.

D. W. F. HATTEN,
Stock Inspector, Bourke.

AT the invitation of Mr. Rodier, I went out to Tambua on the 31st March, 1905. Mr. Rodier was absent, but his overseer, Mr. Finley, was in charge, to whom I explained the object of my visit, which was to inspect Tambua, and make myself acquainted with the method of destroying rabbits by Mr. Rodier, *i.e.*, killing the does and letting the bucks go alive.

I was surprised to find Tambua such a rough piece of country. We drove across the run and nearly all round the boundaries, which are netted—15 miles of 42 in. x 1¼ x 17 B.W.G. netting on the N.E. and part of S.E. boundaries, 15 miles of 36 x 1⅝ to 1¾ x 17 on the S.W. and remainder of S.E. boundaries, and 10 miles of 42 x 1⅝ x 17 on the N.W. boundary.

I found that recently a strip of 14 in. x 1¼ x 17 was attached to the 36-inch netting. Mr. Finley explained that this was done to prevent small or young rabbits getting through the 1⅝-inch mesh, thereby ensuring extra precaution, and to increase its efficiency. I saw twenty-seven rabbits during the day's drive of about 50 miles on Tambua. The whole of the boundaries are in good repair, although not thoroughly rabbit-proof, owing to 1⅝-inch mesh being used. I saw several pit-traps on the boundary fences, but none in working order. The pasturage was fairly good but dry, with the exception of some patches, where recent thunderstorms had fallen, which were partly green, but there was abundance of dry grass and herbage all over the run. In the horse-paddock at Tambua, young salt and cotton bush was growing luxuriantly; no traces of rabbits to be seen. The pasturage on the whole of the run seemed to be unaffected by the rabbits. I saw a number of rabbit warrens uninhabited. The rabbits I saw were about the creeks and washaways. By such places Mr. Rodier has erected a barrier fence below the boundaries. There are a number of these washaways on different parts of the boundaries. The creeks have very sandy banks and flats, being most suitable ground for the home of the rabbit, and difficult to deal with. During my visit Mr. Finley took me to their rabbiters' camps (2), counted the scalps of the does and half ears of the bucks for the three months of this year ending 31st March; 785 bucks had been ear-marked and let go alive, and 1,278 does were killed and scalped, making a total of 2,063 rabbits, which is a proof that the rabbits are well under control. On the adjoining holdings I saw large numbers of rabbits and no grass, the country eaten quite bare, which is sufficient proof that Mr. Rodier's plan has proved successful, whether by

letting the bucks go alive or his energy and systematic trapping, I cannot say; anyhow, Mr. Rodier deserves very great credit for his perseverance in controlling the pest.

At the time of my visit the stock on Tambua was 5,000 sheep, 400 cattle, and 40 horses, all in splendid condition. The only means of dealing with the pest on Tambua since 1888 have been trapping rabbits alive, killing the does, and liberating the bucks after ear-marking for identification, if again caught, also dealing similarly with neighbours' rabbits caught in boundary fence traps, the bucks being released on Tambua. No record is kept of bucks caught a second time, which I think is a mistake in proving the efficiency of the method (if such can be proved). The trappers are provided with ten to twelve slow dogs, which run the rabbits into the warrens; if large ones, a Tambua trap is set at each opening. This trap is capable of catching from seven to nine rabbits alive, and can be emptied without removing the trap. This trap is a most useful and ingenious contrivance. For this invention Mr. Rodier deserves the highest commendation. I am satisfied his success in coping with the rabbit-pest is mainly due to these traps and dogs, digging out, destroying cover, &c. Each rabbiter is provided with from 250 to 300 of these traps, which are carted out to different points, handy for the trappers, to carry from one burrow to another when required. Mr. Rodier estimates that 500 of these traps, ample for (say) 64,000 acres, would cost, approximately, £125. The average expenditure for thirteen and a half years, exclusive of plant, is shown to be £118 10s., as per appended schedule handed to me by Mr. Rodier.

The total average cost for Tambua, exclusive of maintenance or cost of netting fences, would be £136, approximately ½d. per acre, which compares favourably with ordinary methods adopted by many pastoralists in the Western Division. It is claimed that for this method, but for the influx from the adjoining area, the natural increase would practically cease, and further expenditure become unnecessary in consequence The theory upon which Mr. Rodier's method is based is that the male rabbits as soon as they begin to predominate persecute the does and prevent them from breeding; they also kill the young, and when they largely predominate in numbers worry the remaining does to death. From my own knowledge this is mere theory, no good in practice. Mr. Rodier claims to have let go 18,116 buck rabbits. Can he say what has become of these? I am convinced that they are not on Tambua, nor will any part of the netting fence in the district keep them in. During the year two buck rabbits bearing Mr. Rodier's ear-mark were caught on Yanda. Numbers of Mr. Rodier's rabbits have been caught on Messrs. A. C. and J. Mackay's homestead leases (resumed area of Gundabooka), where some 15,000 rabbits were destroyed—trapped at tanks; also three were caught in the bend of the river above John Mackays', senior, homestead, Clover Creek. Mr. Robert McKay Tully, of Woodlands, near Louth, assures me he poisoned several buck rabbits bearing the Tambua ear-mark at some of his tanks. These rabbits were poisoned in the months of February and March last. On receiving this information, I visited these

holdings for the purpose of satisfying myself of the correctness of these statements on the 16th and 17th instant, and found the dead rabbits had been carted away from the tanks and thrown in heaps, and were decayed and shrivelled up beyond recognition. However, I found three in a state of preservation bearing Mr. Rodier's ear-mark (half the near ear off). These rabbits are found 70 miles from Tambua. Mr. Cuthberth Fetherstonhaugh makes mention of similar circumstances where buck rabbits had been treated in the same way as Mr. Rodier treats those on Tambua, being found 60 miles away from where they were marked. (See the *Pastoralists' Review*, April number.) With these facts before us, how can we accept Mr. Rodier's theory as practical? I fail to see how it can be pronounced a success. Had Mr. Rodier destroyed the 18,116 buck rabbits which he let go alive on Tambua, he would have proved himself a public benefactor, as by turning them adrift he has spread them on his neighbours. If he had followed his splendid method of trapping, I feel sure he would have accomplished his end, especially if his neighbours had followed the same plan and taken advantage of the hot summer months by using poisoned water. We must all admit that if the water can be controlled and advantage taken of the proper season, the rabbits can be held in such check that they would not do much damage to the pastures. The great disadvantage in using poisoned water, unless used with precaution, is the destruction of so many beautiful birds and natural enemies of the rabbit; besides it can only be used to advantage in dry seasons. Landowners and pastoralists should be ready to take advantage of this opportunity when offering. With reference to Dr. P. L. Sclater, M.A., F.R.S., and his reference to Mr. Rodier's plan, I can say it only applies to a certain extent amongst other animals in this country; besides, in the case of the rabbit, my fears are that if we have to wait for the males to persecute the females to death by their attentions, Australia will never be rid of the pest. Mr. Rodier has had fifteen years' trial on Tambua, and his object is not yet achieved. From his own figures he plainly shows he has been assisted by the drought. Take the years from 1898 to 1904 for example. I note Mr. R. Etheridge, Curator of the Australian Museum, was favourably impressed with Mr. Rodier's scheme; also Mr. W. B. Tegetmeier, writing in the English *Field*, is in favour of it.

The opinion of these eminent gentlemen is admitted a strong factor in favour of the Tambua system; at the same time, these opinions are based, to a certain extent, on scientific theory. We must or should rely upon our own practical knowledge. What is the cause of the doe rabbits being in the majority? The bucks, according to available information, have not predominated in any one instance. My opinion is that they have got out of the enclosure, and scattered over the country, as they do under ordinary circumstances. I have seen too many rabbits get over wire netting fences to accept the idea that they can be kept within an ordinary 36-inch netting fence, especially the bucks. I freely admit netting fences are a barrier, and stop the main wave, but if there is good feed on one side of a fence, and the rabbits are strong, they will get over the netting continually to the feed—that is, numbers

of them will. I know this to have happened in many instances in this district since the rabbits first appeared here in 1887. In my capacity as "Stock Inspector," I travel from 8,000 to 9,000 miles every year, visiting every holding in my district two and three times during the year, the majority of which are netted, consequently I can speak from my own practical knowledge, and former experience as a pastoralist.

RABBIT DESTRUCTION IN TAMBUA.

For 12 months ending—	———			Does killed.	Bucks let go.	Remarks.
	£	.	d.			
30 June, 1892 ...	496	11	10	9,861	6,948	By tank trapping from 5 Oct., 1891, to 31 Mar., 1892.
,, 1893 ...	260	0	0	3,980	2,253	From 1 Apl., 1892, to 28 Feb., 1895, by Tambua traps.
,, 1894 ..	102	5	0	....	... .	
,, 1895 ...	121	5	0	4,150	3,071	1 Mar. to 31 Dec., 1895.
,, 1895 ...	201	12	3	....	.. . .	For 6 months ending 31 Dec.
,, 1896 ...	60	8	2	4,779	2,916	For year 1896.
,, 1897 ...	70	7	4	1,894	1,118	,, 1897.
,, 1898 ...	83	14	7	801	431	,, 1898.
,, 1899 ..	32	3	8	59	16	,, 1899.
,, 1900 ...	42	8	10	53	22	,, 1900.
,, 1901 ...	23	7	6	65	24	,, 1901.
,, 1902 ...	6	1	8	6	1	,, 1902.
,, 1903 ...	6	6	2	29	7	,, 1903.
,, 1904 ...	100	15	2	2,450	1,309	,, 1904.
Totals ...	1,607	7	2	28,127	18,116	For 13½ years.

Average—£118 10s. expended, 2,124 does killed, and 1,368 bucks let go yearly.
Run netted in at end of 1891.
From 1st April, 1892, only Tambua traps used.
Expenditure for 1890, £162.
Expenditure for 1891, £152.

What chance would Mr. Rodier's plan have of checking the rabbit pest on some of our larger holdings, unless subdivided by wire-netting into, say, 60,000-acre blocks? It would take a lifetime to work his system of trapping and hunting with success. Mr. Rodier's system can easily be put to the test; say the Government fence securely an area of 1,000 acres or so, irrigate a portion, and grow lucerne and grass, subdivide, and follow Mr. Rodier's system, for, say, twelve months, or two years, see that a fair number of rabbits are within the enclosure. This could be done at a comparatively small cost, and would settle the question for all time, and go to prove whether or not the males that are caught and liberated would render the females not caught sterile, and, kill all the young ones that may be born, undoubted proof is what is wanted.

This would prove the efficiency of the scheme that Mr. Rodier points out, when the females are killed out, which would be in a year or two, by following this plan the males will die off by old age, their natural enemies, and fighting amongst themselves; the average life of a rabbit in England is eight

years, but I am satisfied, under favourable conditions, they live much longer in Australia, up to twelve years or more, probably fifteen, unless overtaken by drought, or some other cause. This being the case, it would take a lifetime to clear a run of, say, 300,000 acres, by adopting the Tambua scheme. Such are my convictions, which are open to criticism. Mr. Rodier is deserving of every credit for his persistence. That some great and wide-reaching scheme must be put in operation to suppress the rabbits is acknowledged by every landowner.

The Minister has sanctioned the "Rodier" system, but it can only be used as a means of destruction without the approval of the Board. Under section 62 of the Act of 1902, it is illegal for any person to liberate a rabbit. I take it that if the Board choose to sanction any scheme, then the liberation of rabbits in that aid will become legal. As the law stands, it is illegal to lay poison on stock routes and reserves; any person doing so is responsible for losses to stock travelling, therefore it is necessary the law should be altered to enable people to poison these lands.

Paspalum Dilatatum.

The article in the May *Gazette* on *Paspalum dilatatum* is of great interest. My experience of the grass may be of interest to you. I may say I have not seen its equal for adapting itself to any condition and kind of soil, or withstanding drought, fire, and flood. Having been at Wyee, you know the kind of soil hereabout. Some years ago I obtained a small packet of seed and scattered it around, some in sandy soil, where it grew and prospered; some in a stiff soil, which has a large proportion of clay in its composition; some in the garden; and some in a hole often covered with water, and it seemed to thrive alike in all places. In the garden, where the soil was good, of course it made better growth. This year we had seven months with scarcely any rain, the soil was cracked all over with deep sun cracks, everything was parched and dry, and then, over all, the bush fire passed, and then a flood; notwithstanding all these adverse conditions, *Paspalum dilatatum* came up smiling, and as strong as ever.

I scatter seed in the bush and all around, and it starts ahead and overruns the indigenous grasses. I am fully persuaded now that if we can get the land here planted with this grass, it will become of some value.—Elliot J. Rien.

Weeds of Bathurst District.

[Continued from page 476.]

R. W. PEACOCK.

Saucy Jack, or Cockspur.

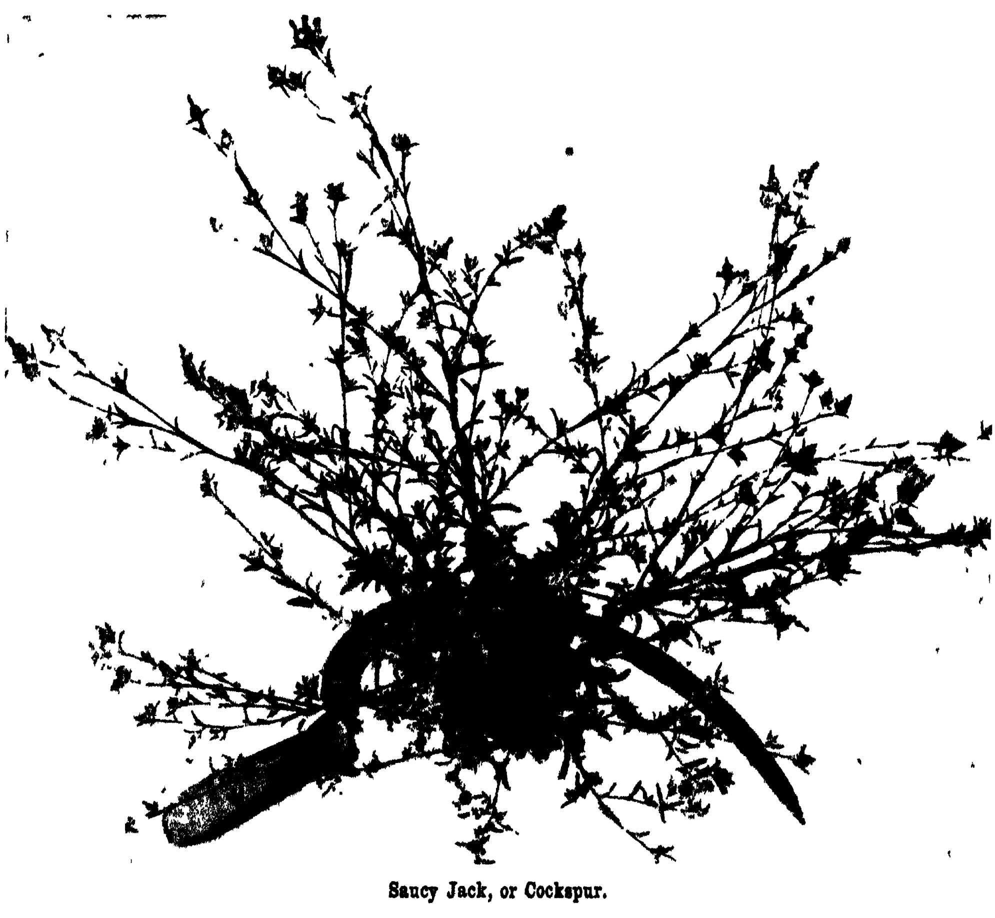
[Botanical name, *Centaurea solstitialis*, Linn. Introduced from Europe.]

ONE of the most troublesome weeds in wheat fields. It grows throughout the summer, producing flower heads protected by sharp spines about harvest time, which, before the introduction of machinery, caused considerable annoyance to the reapers. When the crop is harvested by machinery large quantities of the weed are taken off the field, and if ploughed directly after harvest it is kept in check.

This weed thrives in waste places, and around stumps and trees. Clean cultivation, rotation of crops, and summer ploughings are the best methods of eradicating it.

Stock will eat it, but are not fond of it, it having a peculiar bitter flavour.

The seeds are freely disseminated by winds, birds, and stock.



Saucy Jack, or Cockspur.

Hawkesbury Agricultural College and Experimental Farm.

The Hawkesbury Draught Stock.

H. W. POTTS.

At the last show held by the Hawkesbury Agricultural Society, at Clarendon, when declaring it open, the Hon. the Premier, Mr. Carruthers, gave a terse but deeply-interesting account of the earliest settlement in Australia, within a mile or two of the site of the present show-ground and this College. It showed how the Hawkesbury and its tributaries had been associated with the development of production from the dawn of agricultural enterprise in Australia.

In the year 1794, Lieutenant-Governor Grose originated the first settlement, somewhere near the junction of South Creek with the Hawkesbury River, near Windsor. Our earliest agriculturist was James Ruse, who received the first grant of land—30 acres—at Parramatta, in 1790. It was dignified with the title of Experimental Farm, and probably richly deserved it, seeing every crop sown in those days by its owner, with little or no knowledge of local climatic conditions, was speculative and experimental to the newly-arrived Britishers. Ruse sold the farm, and settled on the Hawkesbury, near Windsor. Lieutenant-Governor Paterson, in 1795, records that the settlers had increased in and around Windsor to 400 persons, and their selections extended nearly 30 miles along the river banks.

In 1800, Governor King, in a despatch to the Colonial Office, wrote: "It is to the Hawkesbury that we have to look for our supplies of wheat." In 1801 he states: "From the former abundant crops at the Hawkesbury (which is certainly the finest soil in the world), almost the whole of private industry has been centred there."

In 1801 he further reports the seizure of a Government vessel by desperate characters, laden with 500 bushels of wheat, on its returning from the Hawkesbury.

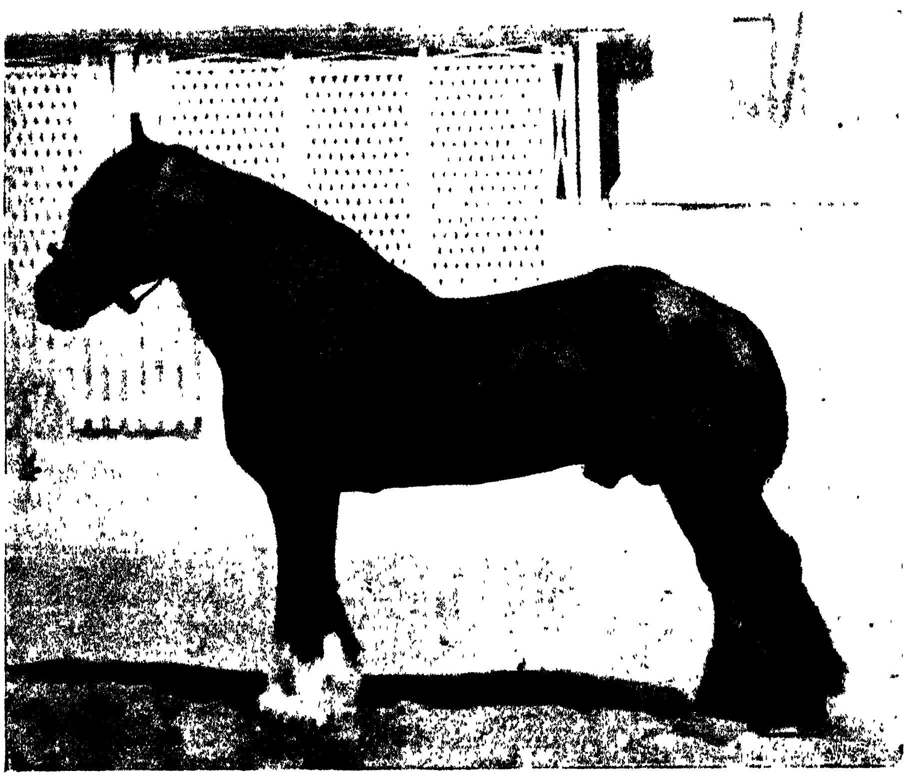
With the rise and progress of the settlement, its purpose and aspirations, it has undergone many vicissitudes. Events seem to hurry on with quickened pace. Wheat-raising has been forcibly abandoned, owing to the invasion of rust; and the vale of the Hawkesbury, with the blue-tinted face of the Kurrajong Heights, has altered in character under the influence and staunch personality of the Hawkesbury natives.

The fruit-growing capabilities of the Heights have been fully explored with strenuous intelligence, and citrus orchards are found flourishing all through those gentle slopes forming the outlying ranges of the Blue Mountains. The famous Hawkesbury Bottoms are utilised for the growth of maize, potatoes,

vegetables, and dairying. Intense culture prevails over the areas swept at uncertain intervals with floods, which deposit their reviving silt and restore fertility.

Here we find most of the farms let to tenants, at rentals ranging from £1 to £2 per acre per annum. It is not an uncommon incident to find a family occupying one farm for over fifty years as tenants.

Where the plough and agricultural implements are so much in evidence it is not to be wondered that more than ordinary attention has been devoted to



"Muir Lad" (imp.).
Clydesdale brown. Purchased by the late Mr. Andrew Town for 1,000 guineas.
From photo. lent by Mr. Alex. Benson, Richmond.

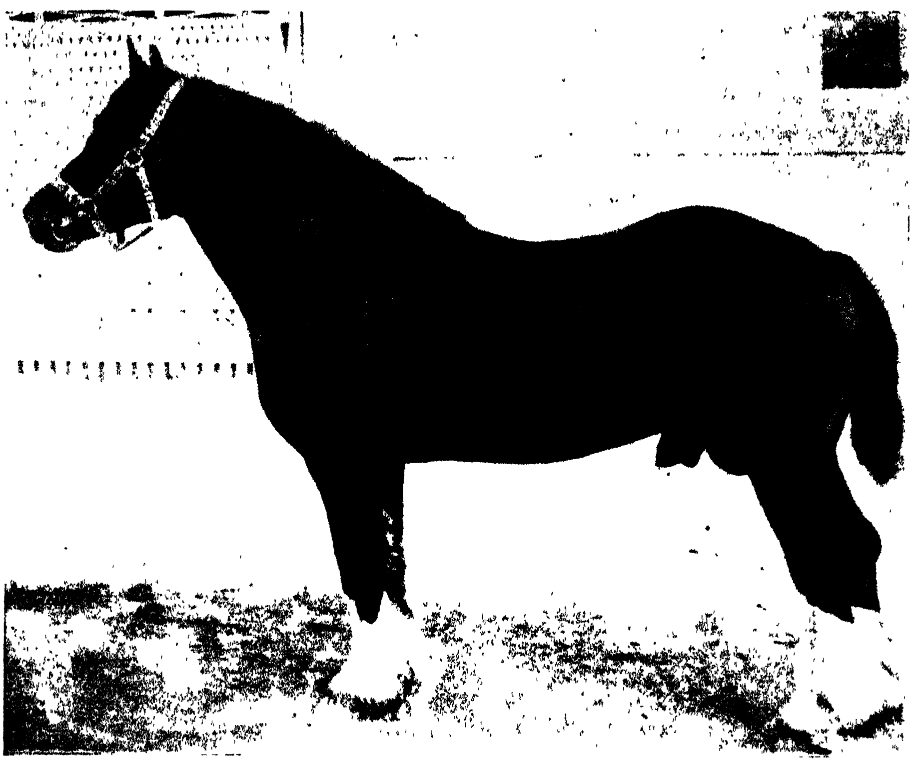
the breeding and rearing of draught horses. In fact, as with wheat, we may realise that the Hawkesbury was the original nursery of the draught stock from which the later studs received their first start.

The undeniable superiority of the British breeds of draught stock, and the foundation of our present studs from such parent stock, is a topic of much interest to all Australian farmers.

In attempting the work of providing a short history of the first efforts to introduce, acclimatise, and improve the best types of draught stock into the Hawkesbury district, it has been a difficult task. Details and considerable information have been kindly furnished by Mr. Samuel Hoskisson, Clifton, Clarendon, Mr. Jas. Holmes, Windsor, and Mr. Tim Reay, Richmond. These

gentlemen have had to rely chiefly on memory. Little or no printed records, photographs, or even pedigrees of valuable imported animals have been preserved. The first importation of note into the district was made by a syndicate of which the late Mr. Thompson, of Clydesdale, was a member, about 1840. The animal was a Clydesdale stallion, about 16 hands, black in colour, very staunch and well built. He stood in the district for several years.

This importation was followed by a number of Shire horses, amongst the most prominent being "Tom of Lincoln," imported by the late Mr. Charles Smith, of Clifton, near Richmond. This horse was black and very big.



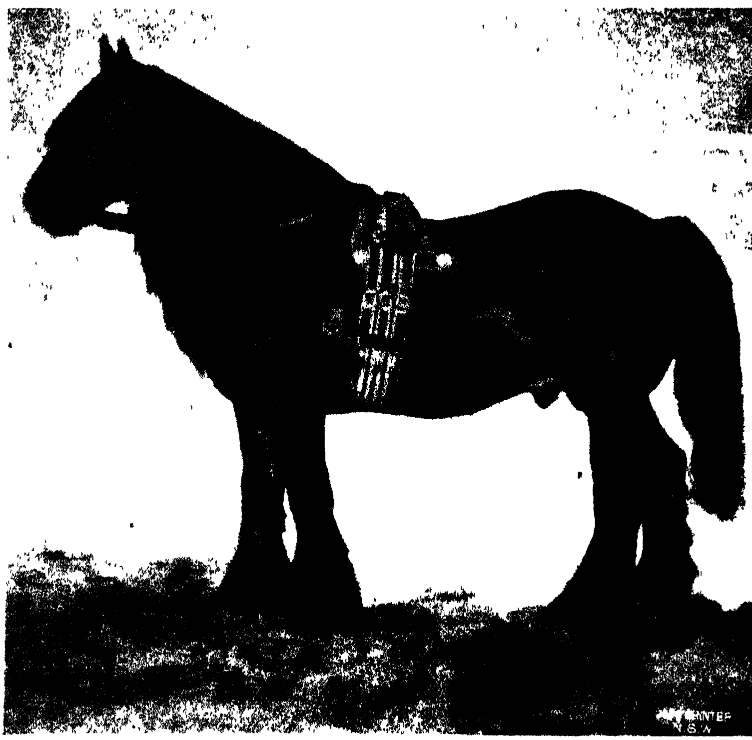
"Gallant Scotchman" (imp.).
Clydesdale bay. Purchased by the late Mr. Andrew Town for 800 guineas.
From a photo. lent by Mr. Alex. Benson, Richmond.

Several of our local horse authorities class this animal as first in laying the foundation of the Hawkesbury draught stock. Then came "Glenrell," a bay Shire, also imported by the same owner, which is reported to have cost between £600 and £700.

"Farmer's Glory" was a grey Shire, imported by the late Mr. Geo. Wilson, of the Richmond Bottoms. This horse lived and died in Richmond, and many of the staunch greys now to be seen in the district trace their lineage back to him. The cost in bringing out imported stallions was very heavy in those days, and the risk heavy. Notwithstanding this, the service fees obtainable were very low, ranging from £1 to £1 10s. per mare.

Mr. Wilson also imported a big chestnut Shire, who stood in the district under the name of "Blind Sam," or the "blind horse."

Mr. Farmer, of the "Black Swan Hotel," Sydney, imported three stallions. "Blue England" (at times called by local men "Young England"); he was too heavy, and only got eight or nine foals, one of which Mr. John Hoskisson, of Clifton, gave 140 guineas for at 6 months old. "Drayman," was considered by some a Clydesdale, and others a Shire. He was on the big side also. Mr. Hoskisson purchased him and "Blue England," to stand in this district, for £800, and also purchased a foal of "Drayman's," 6 months old,



"King Tom" (imp.).
Shire bay. Purchased by the late Mr. Joseph Onus, Richmond, for 800 guineas.
From a photo lent by Mr. T Reay, Richmond.

for 150 guineas. "Blue England" died in 1853. "Brown Prince," completed the trio. Opinions differ as to his breed. He was a beautiful dark bay colt.

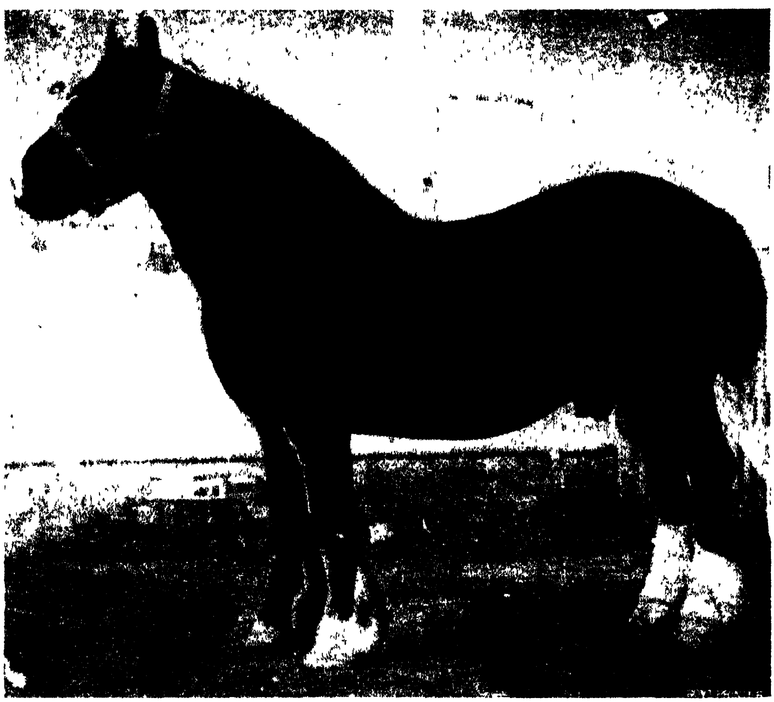
Mr. Bristol Reay brought out two Shires to Sydney, at a cost of 1,300 guineas, "Wiltshire Champion"—a heavy black horse, and "Young Clinker,"—a chestnut, better known later as "Seath's Chestnut Horse." The late Mr. Seath and Mr. Wm. Onus, both of Richmond, bought both horses, and at the end of the first season, they tossed coins for the choice. The former won, and he selected the chestnut. About this time the gold-diggings broke out, and horses soon rose in value. The service fee for these horses reached 6 guineas per mare.

About 1856, a Miss Creasey, of Bull's Hill, Prospect, imported the black Shire "Champion Hero," which travelled through this district. Seven years later this lady imported another Shire, a brown horse, "Matchless." At this time roans among the Shire stock were by no means uncommon.

"Iron Duke," a blue roan, was brought out in the early fifties, and travelled by Mr. Wm. Hopkins, of Freeman's Reach.

"Shakespear," a red roan, and "Waxworks," a blue roan, at Clarendon, were owned by Mr. Dight.

"Young Wonder," a red-roan Shire, is said to have been imported by Mr. Calton.



"Pride of Dunlop" (imp.).
Clydesdale dark bay. Purchased by the late Mr. Joseph Onns, of Richmond, for 800 guineas.
From photo. lent by Mr. T. Reay, Richmond

The Hon. Geo. Thornton imported two valuable Shires, "Conqueror," a grey, and "True Briton," a very attractive bay. These traversed the Hawkesbury Bottoms in the charge of Mr. Ward, Bankstown.

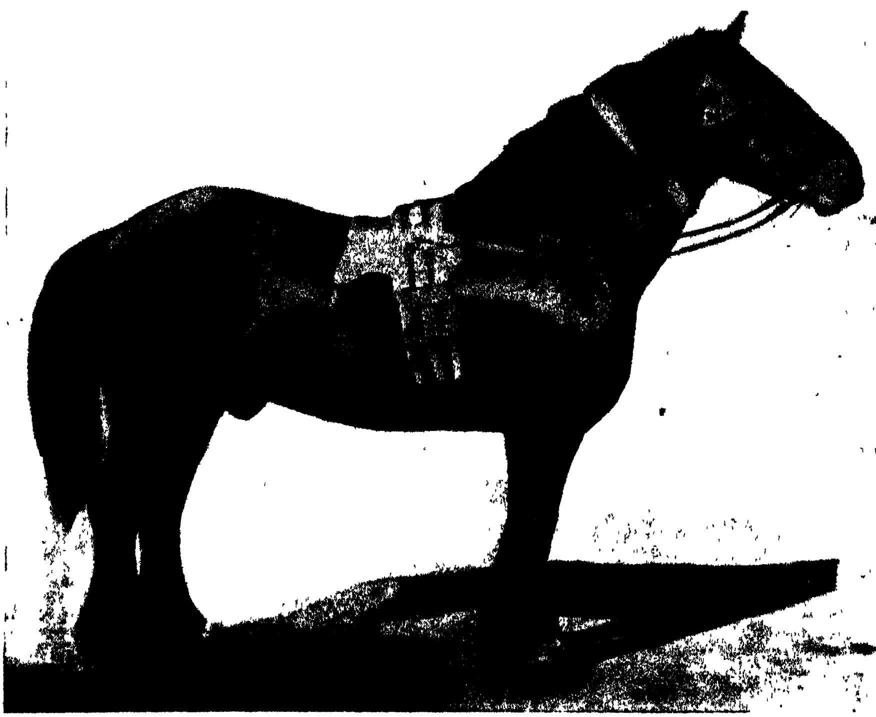
Mr. Geo. Wilson also imported together "Scotch Jock," a brown Clydesdale, and "Invincible," a grey Shire.

A Shire stallion, named "Brown Prince" (evidently the second of that name), was brought out from England by the late Mr. John Seath, of Windsor Road, Rouse Hill. This animal proved very bad tempered, and after biting a man severely in the arm, he was shot. His head now occupies a prominent place in Mr. Tim. Reay's yard, Richmond. Following this the district became renowned for its draught stock, and buyers flocked into it from all parts of Australia. The prominent breeders and owners were the late Mr. Andrew

Town, the late Mr. J. E. Onus, the late Mr. John Seath, Mr. Samuel Hoskisson, and others, who made costly purchases and displayed great enterprise in importing the most valuable animals. The Hawkesbury Agricultural Society's Annual Show provided the finest exhibits of draught horses in Australia.

Amongst Mr. Samuel Hoskisson's horses were "Honest Tom," a bright bay Shire, with black points, imported by Mr. Isaac Wiley, which cost 350 guineas.

"Young Blare," a mottled-brown Clydesdale, imported by Mr. G. S. Yeo, was sold for £600. He travelled through the district for five years, and was then sold to Mr. Rouse for £400.



"Clan Campbell" (imp.).
Clydesdale bay. Purchased by the late Mr. Joseph Onus, Richmond, for £1,000.
From a photo. lent by Mr. T. Reny.

"Carlton Tom," a mottled-brown Clydesdale, imported by Mr. G. S. Yeo, at a cost of £600, served for five years, and died at Clifton, after winning a special prize at the Hawkesbury Show, in 1880.

"Emperor," a mottled-brown Shire, was imported as a 3-year old, by Messrs. Bookless and Scott, of Melbourne, and purchased by Mr. Hoskisson for £1,000. He remained in the district for eight years, and served at a fee of £8 8s. per mare, and left many high-class draughts behind. The same owner also purchased a bay Clydesdale, with black points, for £1,000, named "The Masher." He stood here for five years. At this time Mr. Hoskisson imported two Clydesdale mares, "Darling of Langside," and "Rosie of

Langside," which cost him £500 each. He sold one 2-year old filly, out of "Rosie," by "Emperor," for £200, and refused 350 guineas for another filly, 3-year old, out of the same mare. Mr. Hoskisson is still alive, and relates his triumphs in breeding draughts with remarkable clearness at his advanced age.

The late Mr. Andrew Town, of Hobartville, the well-known estate adjoining the College, also acquired a great reputation as an importer and breeder of Clydesdales, on a large scale. His first imported purchase was "General Chancy," better known as "Scotch Jock," imported about 1880, by Mr. Nesbitt, Melbourne. Another importation by that gentleman was the well-known Clydesdale brown stallion "Muir Lad," and sold to Mr. Town for 1,000 guineas. The service fee, at Hobartville, ranged from 6 to 10 guineas. This powerful animal has left many excellent horses in the district.

"Gallant Scotchman," imported, a bay, was purchased in Melbourne for 800 guineas. He was an active and resolute mover.

"Prince Arthur," a brown Clydesdale, was imported by Mr. Andrew Rowan, Melbourne, and purchased for the Hobartville stud. He was a fine, muscular, weighty horse, with good knees and hocks, well-placed shoulders, good back and loins, clean limbs, well formed and open feet, plenty of bone, and looked on as the best of the stud.

The other Clydesdale stallions in the stud were "Black Prince," "Davie," "Gladstone," "St. Patrick," "Argyle," and "Malcolm of Glamys." Mr. Town also imported several Clydesdale mares, notably, "The Countess," for which it is stated 1,000 guineas was paid. Other mares imported were two "Learmonth" mares, "Bay England," "Brown England," "Burnside Mary," "Liz," "Leslie" (a sister of "Gallant Scotchman"). Mr. Town's stallion "Pride of Richmond," by the "Gallant Scotchman" out of the "Countess," as a 2-year old topped the prize list at the Hawkesbury Show, and took the championship for the best horse on the ground, beating several imported sires.

The late Mr. Geo. Rouse, of Rouse Hill, imported a brown Shire named "Atlas," about 1870, and sold him to Messrs. A. Town and J. E. Onus.

The late Mr. Jos. E. Onus, Richmond, made extensive and valuable purchases from time to time, and assisted largely in building up the reputation of the district for high-grade draught stock. His first purchase was a Shire, a bay, "King Tom," landed in Melbourne, and bought for 800 guineas. His fee was 9 guineas, and he was considered by good judges to be one of the best horses that ever stood in the district. He was exceptionally well-bred. He had plenty of depth and heart room, great depth and length of barrel, and stood on splendid legs and feet.

"Pride of Dunlop," a dark bay Clydesdale, was next purchased at a cost of 800 guineas. He was an animal of great substance and bone, and probably was the biggest horse that ever stood in this district. At one time he scaled 2,217 lb. in weight.

"Charmer," a black Clydesdale, purchased by the same owner for 700 guineas, left many very fine roomy, powerful mares behind.

Mr. Onus's most successful sire was "Clan Campbell," purchased in Scotland by Dr. Galloway, and sent out to Melbourne, where Mr. Onus paid £1,000 for him. He has imprinted the stock of the district with his many fine qualities as a draught.

"Lyon of Lyons," a beautiful bay Clydesdale, foaled in 1878, was brought out in 1882, and Mr. Onus exchanged "Charmer" for him with Mr. Gilbert, of Queensland. His stock were all good and staunch.

The other Clydesdale stallions owned by Mr. Onus were "Shieldbearer,' imported, a magnificent bay, standing 17 hands, "Rajah," "Lord Nithsdale," and "St. Christopher," all costing 500 guineas each.

The last local importation of Clydesdale stock to this district was "Balmedie Enchanter" (10,159). He was imported by Messrs. Lawson Brothers in 1899. He is a dark-brown horse, standing 16·3½ hands high. His sire, "Prince of Albion" (6,178), was sold for £3,000, and his dam was "Balmedie Enchantress," a noted winner at Kilmarnock, Glasgow, and Aberdeen.

Thus we have a brief record of the pure-bred draughts, which have proved important factors in assisting to build up our agriculture.

The general impression left amongst our local farmers is that the horses were too heavy, sluggish and clumsy for general farm operations. Nothing could be said against their staunchness, vigour, and excellent constitutions.

The prevailing verdict is in favour of the Clydesdale, seeing they are more active, hardier, lighter in build, with sound feet and legs.'

(*To be continued.*)

Club Root or Finger and Toe Disease on Cabbage and Cauliflower.

C. T. MUSSON,
Hawkesbury Agricultural College.

During early April a resident of the Blue Mountains submitted for examination young plants of cabbage with enlargements of the roots. It was stated that all the cauliflowers and cabbages in the garden from which the sample plants came had been destroyed, for the tops died off after yellowing, and it was then found that the roots were, as stated, covered with gall-like enlargements.

Examination soon proved this to be a case of Club Root, a trouble common to all Cruciferous plants (cabbage, cauliflower, turnip, horse-radish, and other cultivated forms, as well as wild forms, such as mustard and any cresses).

It appears from inquiries made, that this disease is commonly distributed and, perhaps, spreading ; though doubtless eel-worm galls occur at times and might be mistaken for it.

The actual cause is a fungus parasite named *Plasmodiophora*, one of the Myxomycetes or Slime Fungi, of which several are known as doing damage to various forms of plant life. The trouble has been fully described in an early number of the *Agricultural Gazette* (Vol. V, page 553), where diseased plants are illustrated and all necessary particulars given, the article being a reprint from an early publication of the United States Department of Agriculture.

It is also referred to in Vol. XV, page 700, as one of a group of root troubles attacking Crucifers to be looked out for.

In the plants submitted, the tissues were sound, as the parasite had not arrived at the stage when rot sets in, which it does sooner or later. Enormous numbers of reproductive bodies (resting spores) had been formed by the fungus out of its own substance, and were ready to pass to the ground on the root rotting away.

How the parasite reached the crop, in the case submitted, it would be difficult to say with any degree of certainty, without knowing all the facts. But it is almost certain that these plants were inoculated from the ground; probably, the germs had been there for a year or two; previous crops had been attacked, no doubt, without the trouble having been specially noticed. The soil must have been receiving considerable numbers of spores or reproductive bodies, which lying there for a time, eventually passed the disease on to some Cruciferous root with which it came in contact, and so continued the infection until at last the whole crop was affected.

Growers should be on the lookout for this root trouble, and take immediate steps to stop its advance, by removing all infected plants before rot sets in, if possible. It will be easily traced; the first sign is perhaps shown by the leaves losing their natural healthy colour whilst the plant is young. Examination of the roots will then soon determine if this trouble is the cause.

Treatment.

When present.—Pull up, as stated, all affected plants, taking care that no portion of the root remains in the ground. To facilitate this end the soil may be loosened with a fork or in some other handy way. The pulled plants should be burnt at once; there is no other certain way to kill off the reproductive bodies, which will find their way to the soil eventually if this is not done. As the germs in the soil retain their vitality, it is said, for five years, no plants of the kind named as liable to attack should be planted on the infected ground for six or seven years. Rational rotation should be practised. There are several common weeds of cultivated ground likely to provide means for continuing the pest—Shepherd's Purse, Carrot Weed, and Wild Pepper. These should be rigorously destroyed, or other treatment will be of no avail.

Lime applied to the soil is decidedly beneficial in killing off the spores or germs lying therein; consequently it should be applied periodically wherever this trouble exists. Farm-yard manure is likely to encourage its continued existence, therefore its use is to be deprecated under such conditions. It

would be decidedly injudicious to consign any stems or refuse from disease-infected ground to the manure heap, as that might be the means for spreading the disease broadcast. It may be remarked that no cure is known for this trouble; once existent the only thing to be done is to undertake and carry out a systematic plan for clearing the germs out of the soil by the above-mentioned means.

In gardens *where this disease has not yet appeared*, it is always advisable to take steps to prevent its coming in. Probably a common method of infection is through young plants brought from outside being themselves affected, the trouble being in too early a stage to give any prominent clue as to its presence. The sources of farm-yard manure are also well worthy of investigation. It would well repay us to devote some attention to quarantining all incoming things; examining carefully into place of origin and condition, these being possible means for introduction of pests—whether insect, weed, fungoid, or otherwise; this relates to everything that comes into the place; referring, for example, to old cases, bags, manure, seeds, plants, and the like. In some cases we should, doubtless, not allow admission; in others, thorough purification can be obtained by immersion in some suitable liquid, by fumigation, or in such other way as circumstances would dictate.

Summarising.

1. Growers of cabbages and cauliflowers should keep a sharp look out for this disease, and take early steps to stamp it out, otherwise it will be a matter of great difficulty to do so, and will cause a great amount of time, trouble, and expense in doing it, whilst if taken in hand at once it can be prevented from assuming harmful dimensions.
2. Seedling plants, if brought from outside, should be from clean beds and free from the disease.
3. Attend carefully to rotation, the manurial question, and the keeping down of weeds.
4. Where soil is suitable use lime as a preventive, and for cleansing purposes.
5. These, and other suitable "preventive" measures, will help to keep the disease away.
6. Once present, burn all the plants, and follow out general plan of operations given, fitting them in the special circumstances of the case.

Orchard Notes.

W. J. ALLEN.

AUGUST.

DURING the past month, while giving a demonstration in pruning at Albury, one or two of the growers in attendance complained that their trees had not been doing well during the last two years—in fact, some of them had died and others were very weak, and they attributed this state of affairs to the presence on the trees of a grey substance, some of the trees being nearly covered, while others again were not so badly affected, having, perhaps, only a few limbs so infested; and the fear was expressed that unless the disease could be eradicated many whole orchards would be lost, so fast was the disease spreading and so deadly was its effect.

In order to inspect an affected orchard, I remained in the district another day, and found on inspection that the grey covering on the trees was our old friend the San José Scale. Fortunately for the owner, who proved his good sense by doing so, as soon as he found there was something wrong (which was just about a year ago) he pruned the trees back severely and gave them a dressing of salt, sulphur, and lime solution, which was precisely the best thing he could have done, and on inspecting his trees it was found that there were very few live scales remaining, so effective had this spray proved.

It is a good thing for all growers to watch their trees closely at time of pruning, so that this or any other disease which may show can be treated before it gets such a hold on the orchard, and before it has time to destroy any of the trees. As a matter of fact, no grower can afford to allow his trees to go unsprayed at this time of the year, and the lime, sulphur, and salt solution is about the best all-round spray, as it answers equally well as an insecticide or fungicide.

We have had a few very severe frosts, and it is to be hoped that these will have the effect of destroying the fruit fly, which proved rather troublesome among the peach crop last season.

Owing to the cool weather, citrus fruits have not been in great demand; but this is only what we expect at this time of year. As soon as the warm weather sets in the demand will be as great as in previous years.

Black Aphis.—Several sprays have proved highly effective in destroying this pest. Some growers claim that, for the owner of a small holding, there is nothing so easy to mix or more effective than to dilute a cake of Sunlight soap in 2 gallons of water. This spray can be applied at any time without fear of damaging even the bloom. Others, again, pin their faith to the blue oil emulsion. The resin and soda is also a good spray. It must not be forgotten, however, that one spraying with any of the

above solutions will not eradicate this pest. It will probably take several applications to effect a complete cure.

The latter part of this month is a good time to start the grafting of deciduous nursery stock, and should there be any unprofitable apple, pear, or other trees standing in the orchard, these also may be grafted to good varieties. Grape-vines are easily grafted just as the buds are well swollen and about to burst.

Old peach, plum, and apricot trees will be found much harder to graft than either apple or pear trees. If, however, there are any such in the orchard which are unprofitable, it would be as well to cut them back and graft to better varieties, and, in the event of the grafts not taking, young shoots might be allowed to grow and buds inserted, either in the summer or fall.

At time of pruning, particularly in young apple orchards, a sharp look-out should be kept for the appearance of woolly aphis, and, should any trees be found infested, they should be carefully pruned, removing and burning as many of the infested twigs as possible. Then either scrub the trees thoroughly with a strong kerosene emulsion, or fumigate with hydrocyanic acid gas, so as, if possible, to eradicate this pest.

All old bark should be scraped from apple, pear, and quince trees, and the scraping burnt, and everything in the orchard which would be a harbour for codlin moth destroyed.

Keep all fruit houses as clean as possible, as there is no doubt that they are responsible for harbouring a great many moths every year; therefore, keep the rooms as air-tight as possible, and as soon as the moths begin to hatch in the spring, burn sulphur fumes in the rooms once every other day for a fortnight, so that the moths may be destroyed as they begin to fly.

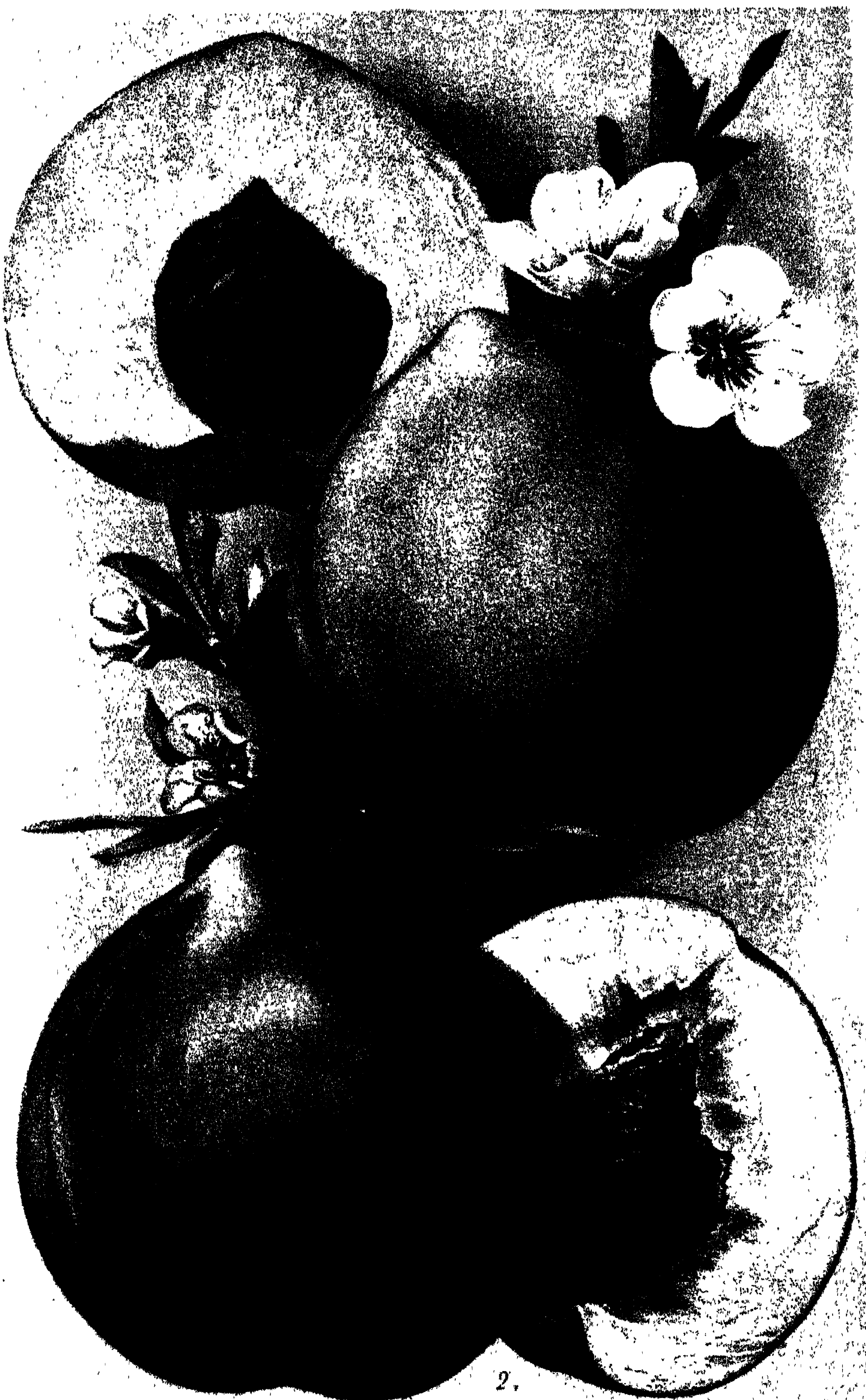
In working around vines keep a sharp look-out for the pupæ of the vine moth. If there are any old partially-rotted stakes, the moths will be found adhering to these, and also under the old bark which is hanging to the vine. Crush these wherever found, and thus assist in keeping down this pest as far as possible.

Growers who intend using quick-acting fertilizers should make the first application this month. It is best not to apply too much at one time, but rather make two applications—one now, and one after the fruit is well set.

COLOURED PLATES.

Foster Peach.—An American variety originated in Massachusets. Tree vigorous, fair cropper. Fruit large, slight suture. Stem set in rather deep depression. Flesh yellow, red at the stone, very rich and juicy. Skin deep orange, dark red in the sun. Freestone. Ripens about a week before the Early Crawford, or from first to last week in January, according to district in which it is grown. Good for drying, canning, and dessert.

Columbia Peach.—Tree upright, fairly vigorous. Fruit large, suture distinct and passing half way round. Skin of a rich mellow yellow inclining to a dull red. Flesh bright yellow, rich and juicy. Freestone. Medium crop of good quality. Ripening from early to late in February, according to locality where grown.



PEACHES.

Farm Notes.

HAWKESBURY DISTRICT—AUGUST.

H. W. POTTS.

ANY casual observer gazing over the vale of the Hawkesbury during the past month, would naturally ask the reason for so many fires in a district where the natural timber has been removed for nearly a century. It is the annual firing of the maize stalks after the cob, or ear, has been removed. These dry, gaunt, unattractive remnants of the summer's growth are looked on as an encumbrance, and useless. The readiest means of removal is the fire-stick. We are indebted to the Americans for maize, the most useful of all fodder and grain plants in warm climates, and to them we owe our knowledge of its growth and treatment. We find that, what is chiefly looked on as useless here, viz., the dried stalk, is largely utilised for fodder in the States, where it is known as Stover, or Shredded Corn Stalks. It is approximately estimated that between eighty and ninety million tons of stover are annually produced on the eighty million acres of maize planted in the States. This is harvested, prepared, and fed to animals in the more densely populated States of the East, but in the great corn-belts great quantities of stover, as in the Hawkesbury Bottoms, are wasted. One noted investigator, Armsley, the Principal of the Pennsylvania State Agricultural College, prepared the following table, showing the relative distribution of digestible nutrients throughout the entire plant when fully mature:—

DISTRIBUTION of Digestible Nutrients in Maize.

	Protein.	Carbo-hydrates.	Fat.	Total.	Per cent.
In the total crop .. .. . ib.	327	3,774	147	4,248	100
In the ears .. . . lb.	224	2,301	125	2,670	63
In the stalk or stover .. .. lb.	83	1,473	22	1,578	37

It is thus shown that about 37 per cent., or about one-third, of the digestible nutrients is found in the stalk or stover, and 63 per cent., or two-thirds, in the ear or cob.

A number of valuable feeding experiments have from time to time been conducted at American agricultural colleges and experimental stations, which go to prove that when maize stover was fed alone, the animals maintained a normal condition; necessarily more dry matter was consumed in comparison with other food such as Timothy hay. The conclusions warranted by these determinations were that "ton for ton maize stover has approximately half the feeding value of Timothy hay when each is used as an exclusive

ration; that it is useful to combine with other foods as roughage; that foods containing larger proportions of protein are best associated with stover, such as lucerne, clover, or cowpea; and that it is useful for dry stock mixed with equal parts of hay or ensilage." It is further claimed that stover can be made to serve for feeding cattle in every way that hay is now employed. In this regard it may be balanced with other foods in the same manner that we balance hay or ensilage to suit the purposes of feeding milking cattle, young or dry stock, fat stock, horses, and sheep.

To most farmers maize stalks, or when passed through the shredder and termed stover, has a most uninviting and unattractive appearance as a fodder, and the inclination is to condemn it as useless. Our experience during the late drought at the College was similar to that of our friends in the States. The dry stock were carried through a period of intense scarcity by means of stover. They maintained good condition and fully demonstrated the value of stover as a fodder Henry's experience at the Wisconsin Agricultural Experiment Station further confirms the feeding value of stover for dairy cattle. He used stover in contrast with mixed and clover hay.

The demonstration was proved on the following basis or table:—

Feed for 100 pounds of milk and 100 pounds of butter, as shown in the trial—

When feeding maize stalks as stover.

For 100 pounds of milk:—	For 100 pounds of butter:—
193 pounds stover.	3·880 pounds of stover.
60 pounds maize meal and bran.	1·233 pounds maize meal and bran.

When feeding mixed hay.

71 pounds mixed hay.	1·348 pounds mixed hay.
62 pounds maize meal and bran.	1·200 pounds maize meal and bran.

When feeding clover hay.

60 pounds clover hay.	1·179 pounds clover hay.
63 pounds maize meal and bran.	1·231 pounds corn meal and bran.

It will be seen we have another stand-by in case of the drought, which is bound to overtake us again. Stover or maize stalks can be stacked and stored for years, to be made available when necessity arises.

In addition to its value as a fodder, stover or maize stalks possess manurial qualities. It would be more sensible and profitable to cut up the stalks and plough them in to burning them. All organic matter tends to enrich the soil, increase its humus, provide food for the micro-organisms, develop useful soil fermentation, and improve its physical and mechanical texture, as well as increase the moisture storage capacity of the soil. In the course of a few weeks the stem is decomposed.

Difficulties possibly assail the maize-farmer when faced with a task of ploughing in the stalks. These are not apparent when a clean, well-burnt surface is in view, but the waste occasioned by burning is too important to be overlooked.

In the older cultivated areas, a marked want of humus is known to exist. This must be met to keep up a profitable return. The same difficulty is met in sugar-growing areas, where farmers now experience the necessity of ploughing in the trash to keep up the fertility of the land to its original value. It cannot be claimed that even our rich soils of the Hawkesbury Bottoms are inexhaustible even with the periodical floods.

It must be patent to all maize-growers that a large factor in soil fertility is lost annually by the bad practice of burning stalks. The most valuable element in our manures or fertilisers—nitrogen—is thus wasted. The potash and phosphoric acid left in the ash on the ground is in a soluble form, and is readily washed away. Where the stalks have been troddden by cattle, they can be harrowed down and turned in with the plough. In the majority of cases, the stalks are left standing, and a more formidable task confronts the ploughman. This, we find, is readily dealt with by using Mitchell's Revolving Maize-stalk Cutter.

Occasionally a stock of stover has been found very serviceable by employing it to mulch fruit-trees in summer. During the season this decomposes, it is ploughed in, and the manurial gain is unquestionable the following season. As a fodder or manure, maize stalks can be converted into profitable use, and no farmer is justified in burning them.

The rainfall has been sparse for the season. Heavy frost prevailed during July, and will probably continue through August. The ground is somewhat dry for farming operations. The land should be got into good order, and where maize is to be grown, well-drained. Rich, friable soil should be deeply ploughed and got ready for early sowing. On the lighter soils of the Hawkesbury sowing may be commenced this month. Where the prospects point to a dry season, the early-sown crops pay best, the varieties which take longer to mature should be selected, such as Iowa Silvermine, Riley's Favourite, Pride of the North, and Hickory King.

Sorghums and Millets.—Early sowings may be made if the weather be favourable towards the end of the month, to provide early crops of green fodder in summer. The most reliable way to sow this crop is to drill 3 feet apart, so that cultivation may be adopted if there be an absence of moisture.

Pumpkins and Melons.—In the case of these useful plants, weather conditions again have to be considered. The young plants are very susceptible to frosts, and the time of planting will be controlled by prevailing temperatures.

Mangolds and Sugar-beet.—These useful root-crops have so far never been grown in sufficient quantity in the district to demonstrate their usefulness for dairy cattle. Soil and climate are particularly favourable, and, as dairying is on the increase on the flats, our farmers will be wise to test their growth. The land must be well cultivated and subsoiled to a depth of 12 to 15 inches. The seed is best sown on ridges, in drills 20 to 30 inches apart, and later on the plants thinned out to 20 inches. Where the soil is rich and deep the best returns will be gained from the variety known as Mammoth Long Red. In the sandier and weaker loams Yellow Globe is the better.

In fertilising the soil apply heavy dressings of farm-yard manure; failing this use kainit and superphosphate. With sugar-beets apply blood-manure and superphosphate.

Rye.—Late sowings of this crop on the poorer uplands of the district may be made this month to provide green fodder.

Potatoes.—The main crop has to be seriously considered this month and active preparation made. The ground should be ploughed roughly and exposed to weathering action as much as possible, followed later on by fine cultivation and heavy manuring. The latter must be determined by the nature of the soil. Farm-yard manure gives good results, any quantity ranging from 10 to 20 loads to the acre. Where a complete fertiliser is required, either to supplement the stable manure or provide it solely, the following will be found suitable :—

4 cwt. Superphosphate.
1 „ Sulphate of Ammonia.
1½ „ Sulphate of Potash.

Drills may be struck out at distances of 3 feet. Plant the early varieties 15 to 18 inches apart, and the late ones 18 to 20 inches. The red-skinned and dark-coloured potatoes secure preference from buyers. Brownell's Beauty, Queen of the Valley, Early Rose, and Bliss's Triumph have in the past.

Sweet Potatoes.—It will be necessary this month to select suitable spots to propagate plants for the coming season. See that a bright warm spot is chosen, framed in, and covered with light frames on which hessian is spread, to make provision against late frosts. Use light, rich, loamy soil, with a good proportion of clean sharp sand, well-rotted stable manure or leaf mould. Pack the tubers closely together on the soil, cover lightly with it and water freely. As the warm weather sets in numerous shoots will appear from which cuttings can be taken for the future plants.

Riverina District.—August.

G. M. McKEOWN.

Lucerne.—Should be proceeded with as early as possible. The recent copious rains will have brought the land, which has been prepared, into excellent condition, and seed should receive a good start. Pastures which have become hard and scanty through long grazing will be improved by ploughing and re-sowing.

Potatoes.—Planting should be carried out in August and September. Land should be deeply worked and brought into a fine state of tilth. Medium-sized tubers may be planted whole, the larger ones being cut into pieces, each set having two or three eyes. Drills should be struck out about 3 feet apart, and the sets planted about 15 inches apart in the drills. Land which has previously received an application of stable manure will give the best results,

if assisted by some of the special potato manures which are obtainable from reliable vendors. Goulburn Redskin and Adirondack will be found useful kinds.

Green Fodder.—Prepare land for sowing sorghum and millet.

Vegetables.

Sow tomato seed in well prepared and protected beds for later transplantation. Dedham Favourite, New Noble, Holmes' Supreme, and Fordhook First, are excellent varieties.

Cultivate all growing crops and, if necessary, water cabbage and cauliflowers.

Mixing Rabbit Poison.

The following ingredients are necessary for the pollard mixture used on the Wagga Experimental Farm, and which is always readily taken, even when green feed is plentiful:—

2 sticks Phosphorus.
3 lb. brown Sugar.
5 ,, Molasses.
$\frac{1}{2}$ oz. ground Cinnamon.
16 lb. Pollard.
4 ,, Bran.

Place the phosphorus in a pickle-bottle or a fruit-bottle which has been previously almost filled with water, and add one tablespoonful of carbon bisulphide; let it stand for about 12 hours to dissolve the phosphorus; dissolve the sugar and molasses in 5 pints of boiling water, adding the cinnamon, and well mixing the whole. Make up the liquid to 20 pints, including the contents of the phosphorus bottle and place it in a large iron tub, gradually adding the pollard and bran, and mixing the whole thoroughly with the aid of a wooden paddle, till it attains the consistency of thick cream. The hands may then be used so as to remove all the material from the bottom of the tub, thus preventing any of the phosphorus from remaining there and so ensuring its complete admixture with the rest of the material. This is necessary to prevent the risk of firing after distribution. Continue adding the pollard and bran until the mixture reaches the consistency of stiff dough, when it is ready for use.

The material should be laid while it is in a fresh condition, as it is more readily taken by rabbits. An increase in the quantity of bran will correct any tendency to stickiness and the cinnamon makes the baits very attractive.

Phosphorus should always be broken or cut under water to prevent the danger of fire.

The quantity of material above described should place baits 2 feet apart over a course of over 25 miles.

The use of covering machines is strongly recommended, as if driven by a careful man there is practically no risk to stock, and very few birds are poisoned. Covered baits are more readily taken by rabbits than those which are exposed, as they do not become stale and hard.

Glen Innes District.—August.

R. H. GENNYS.

Wheat.—It is getting very late for sowing this cereal, still it is by no means impossible to obtain a fair crop should the spring be favourable. It may still be sown for hay crop, but much more seed to the acre should be put in.

Oats may still be sown for grain; rusty varieties should be avoided. *Algerian*, *Danish Island*, *Red Rust-proof* are sorts likely to do well; they are all good hay sorts. Red Rust-proof comes in very early.

Barleys may be sown for green fodder. It is getting late for malting varieties; but Cape and Skinless, the latter especially, a quick-maturing sort for green stuff, may still be sown.

Ryes may be sown for green feed; *Emerald* is a good variety for this district.

Fruit-trees may be planted early in the month, although July is to be preferred. The soil should be deeply worked, trenched, or subsoiled to a depth of from 15 inches to 2 feet. The subsoil plough may be used for this work with good effect. It must be remembered that before planting is the time to work up the ground intended for an orchard, as this never can be done thoroughly afterwards. The importance of this should not be overlooked by intending fruit-growers. August is a good month for pruning in this district.

Clarence River District.—August.

T. WALDEN HANMER.

This district has been suffering from a small drought, very little rain having fallen since early in May. The dry weather has been accompanied with several frosts, notably that on the night of 5th July, which old residents declare was one of the worst on record. At Grafton Experimental Farm the mercury dropped to 25°, and ice could be found on the swamp. No doubt, however, this severe weather will be beneficial is killing numbers of weeds. Lantana up this way has received a bit of a check; cane, however, will suffer. I understand that the Colonial Sugar Refining Company's mill at Harwood is in full swing, and it is expected 80,000 tons will be crushed this season. This does not sound as if cane-growing was on the decline. The cold snap is very trying for all kinds of stock, who must feel it quite as much as we do. Milk supplies are down to a minimum in spite of fair supplies of feed, which makes us more convinced than ever of the great advantage derived from either rugging cows or having a warm shelter-shed for them.

August is a very busy month with farmers who are preparing land for all kinds of crops.

Broom Millet.—Prepare the land thoroughly, and bring to a fine tilth. Sowing should be done in drills 4 ft. 6 in. apart, and the seed dropped so as to have the plants 3 in. to 4 in. apart in the rows. White Italian seems to be

the most favoured variety, although Red Italian and Evergreen sorts are preferred by some manufacturers. Hill the plants when about 6 inches high, and keep the land well worked with a cultivator as long as possible to check the weeds, &c. Early sowing of maize may be made this month, also lucerne, if the weather is favourable, and all kinds of grass seeds.

Oats, Barley, &c., for green feed. We notice already several have com pleted planting potatoes in this district, but August is generally a suitable month.

Vegetables.—Plant out chokos on trellis or near a fence, they are very useful in the kitchen. Sow French beans, cabbage, cauliflower, Kohl-rabi, lettuce, parsley, turnip, beet, &c. Plant out Jerusalem artichokes, rhubarb, and yams.

Finish pruning in the orchard, and spray trees with sulphur, lime, and salt, winter strength.

Richmond River District—August.

C. H. GORMAN.

The time is now opportune for the land intended for spring crops to be thoroughly prepared, and it should be remembered that this is a most important matter. In the first place, the land should be thoroughly cleaned of all foreign matter, and as the weather is cold and frosts are about, the work will be of a more effective nature if taken in hand at once.

On land that is already prepared, oats, barley, vetches, field-peas, mangels, swede turnips, and rye may be sown. The following weight of seed per acre will be required:—For oats, 1 to 2 bushels; barley, 1 bushel; vetches, 1½ bushels; field-peas, 28 to 35 lb.; mangels, 6 to 7 lb.; swede turnips, 3 to 5 lb.; rye, 1 to 1½ bushels. In the case of oats, barley, vetches, field-peas, and rye the quantities given are for broadcast sowing, and for mangels and swede turnips for drilling. Both the latter will be found of great value to dairy farmers, and in some parts of this district will grow very well.

Rape and thousand-headed kale are two crops that should be given a trial by farmers raising pigs, or by those keeping a few sheep. Apart from their value as fodder producers, they are of great consideration as soil renovators. Rape especially grows well in this district, and trials have been in every way very satisfactory. The late Mr. J. L. Thompson, respected by everyone, and looked upon as a thorough farmer, once remarked that no man could be considered a farmer if he did not grow rape for some purpose or other. In feeding it to dairy cattle, it is advisable not to feed alone, owing to the taint in the resulting milk, but if fed in combination the taint will be counteracted. About 6 lb. is required to sow an acre broadcast, and 2 lb. drilled. It is an excellent crop in rotation.

To those desirous of planting shade trees the present time is most suitable for setting them out. Very little attention seems to be given to this matter

and people hardly seem to recognise the value of good shelter-belts. Nothing is more valuable or picturesque than a few good clumps of shade trees, and no trees are of more value than some of the native trees of the district, notably the Teak and Bean. We often hear of ornamental trees of various kinds being spoken of as beautiful, but none of them can compare with the native trees of this district, and the wonder is that some enterprising nurseryman has not catalogued them for sale. There are, of course, ornamental trees of very great use and beauty, and there is no reason why they should not be put out as well as the native trees mentioned. The great thing is to get them out. It is becoming more noticeable every year how bare the country is becoming, and how badly off the farms are for shelter, and later on it will be found a very serious problem. I strongly urge farmers to plant shade trees, and the following might be mentioned as most suitable to the district:—The native trees already mentioned, Camphor Laurel, Oriental Plane, Sugar Gum, Blue Gum, Cootamundra Wattle, Silver Wattle, Jacaranda, Weeping Fig, and the large variety of Pittosporum. There are other varieties of trees that will give satisfaction, but the above are a nice lot and suited for shade and ornament.

The pruning of all kinds of fruit and ornamental trees should be now completed, and it will be found advisable to spray thoroughly after having cleaned up. Salt, sulphur, and lime will be found the best spray for winter. This district is so well adapted to the growth of insect and fungus pests that it will be found advisable to take the most extreme caution in handling prunings, &c., from trees. They should be heaped up and burned with as little delay as possible.

In planting out fruit-trees, see that the best sorts are obtained. It is just as easy to look after a good variety as a bad one, and certainly more profitable. Select good varieties in the first instance

Crown Lands of New South Wales.

THE following areas will be available for selection on and after the dates mentioned :—

FOR HOMESTEAD SELECTION.

H.S. or S.L. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
			a. r. p.		a. r. p.		£ s. d.	1905.
*978	Dubbo	....	2,313 0 0	11	150 0 0 to 275 0 0	Dubbo, 3 to 6	5 5 0 to 6 17 6	17 Aug.
*977	Grenfell	....	....	1	65 3 0	Cowra, 24 ..	1 4 8	14 Sept.

* Available for "originals" only.

FOR SETTLEMENT LEASE.

H.S. or S.L. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
			a. r. p.		a. r. p.		£ s. d	1905.
*800	Barmedman	Ariah	4,200 0 0	2	1,600 0 0 and 2,600 0 0	Grong Grong, 33; Warri Public School, 10 and 12; Barmedman, 35.	23 6 8 and 35 4 2	10 Aug.
*801	Coonabarabran	Caigan	.	1	1,100 0 0	Coonabarabran, 29 to 35; Mudgee, 80 to 86.	9 3 4	24 ,,

* Available for "originals" only.

FOR IMPROVEMENT LEASE.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.

EASTERN DIVISION.

			a. r. p.		a. r. p.		£ s. d.	1905.
601	Rylstone .	....	....	1	3,500 0 0	Carwell, 6; Rylstone, 12.	18 4 7	Sale, 5 Aug.

For Conditional Purchase.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		a. r. p.			£ s. d.	1905.
Armidale	Long Flat	44 0 0	George	Clarke ..	2 0 0	10 Aug.
,, ..	Torryburn	71 0 0	Yarrowick .. .	Hardinge ..	1 0 0	24 ,,
Balranald ..	Yanga	180 0 0	Chadwick .. .	Caira.. ..	0 13 4	10 ,,
Bellingen* ..	....	300 0 0	Coff	Fitzroy ..	1 0 0	24 ,,
,, * ..	....	500 0 0	Never Never	Raleigh ..	1 0 0	21 Sept.
Cassilis	....	1,310 0 0	Lorimer	Bligh ..	1 0 0	10 Aug.
Forbes*	Towyal	2,400 0 0	West Plains ..	Gipps ..	1 5 0	10 ,,
Glen Innes* ..	....	1,760 0 0	Mann .. .	Gough ..	1 0 0	7 Sept.
,, ..	....	173 0 0	Willy	Gresham ..	1 0 0	7 ,,
Grafton* ..	....	290 0 0	Bardsley .. .	Fitzroy ..	1 0 0	24 Aug.
Grenfell* .	....	645 0 0	Eualdrie .. .	Forbes ..	1 10 0	7 Sept.
Gundagai ..	Yabtree	130 0 0	Yaven ..	Wynyard ..	1 16 8	21 ,,
,, ..	....	67 0 0	Cooba	Clarendon ..	0 6 8	10 Aug.
Hay	Harding	100 0 0	Howlong	Stuart ..	1 5 0	10 ,,
,, ...	Gunbar .	830 & 1,240½	Mea Mia North, Carrego, &c.	Nicholson ..	0 13 4	14 Sept.
,, .. .	,, ...	600 & 243	Whealbah South ..	,, ..	0 16 8	14 ,,
,, . ..	,, ...	1,460 0 0	Churnside .. .	,, ..	1 0 0	14 ,,
Lithgow.. ..	....	3,000 0 0	Drogheda and Kowmung, &c.	Westmoreland	1 0 0	31 Aug.
,, * ..	....	800, 740, & 850	Kowmung, Abercorn, & Drogheda	,, ..	1 0 0	31 ,,
,, † .	....	6,352 3 0	Hartley and Kanimbla.	Cook .	0 15 0	31 ,,
Molong .. .	....	350 0 0	Narragal . ..	Gordon ..	1 10 0	24 ,,
Moruya .. .	....	1,490 0 0	Bateman	St. Vincent ..	0 13 4	21 Sept.
Parkes .. .	....	232 3 0	Botfields .	Cunningham.	0 16 8	7 ,,
Port Macquarie*	....	640 0 0	Burrawan .. .	Macquarie ..	1 0 0	17 Aug.
,, *	.. ...	700 0 0	Debenham and Hastings.	Macquarie and Hawes.	1 0 0	21 Sept.
Rylstone .	....	340 0 0	Glen Alice . .	Hunter ..	1 0 0	17 Aug.
Stroud . .	....	120 0 0	Alfred .	Gloucester .	1 0 0	7 Sept.
Tenterfield ..	....	315 0 0	Romney .	Clive.. ..	1 5 0	17 Aug.
,, ..	....	5,000 0 0	,, .	,, ...	1 0 0	17 ,,
,, * .	Deepwater.. ..	315 0 0	Rowney	Clive . .	1 5 0	17 ,,
Wagga Wagga .	.. .. ..	810 0 0	Elliott .	Bourke	1 16 8	21 Sept.
Warialda .	Gragen and Graman	109 0 0	Redbank .	Arrawatta	1 0 0	14 ,,
Wellington .	.. ... .	760 0 0	Ironbanks . ..	Wellington .	1 0 0	7 ,,

* Available for original conditional purchase only.
† Available for original conditional purchase or conditional lease.

Conditional Purchase as Special Area.

Grafton Land District, within the Grafton population area, 730 acres, in the parish of Elland, county of Clarence; maximum area, 118¼ acres; minimum area, 63 acres; distant 2 to 4 miles from South Grafton; capital value, £1 10s. per acre. Available for original conditional purchase only, 31st August, 1905.

Molong Land District, 59 acres, in parish Collett, county Ashburnham; maximum and minimum area, 59 acres; price, £1 10s. per acre. Available 21st September, 1905.

Port Macquarie Land District, within the Port Macquarie population area, 897 acres 2 roods 13 perches, in the parish of Macquarie, county of Macquarie; maximum area, 98 acres 2 roods 24 perches; minimum area, 9 acres 1 rood; at 1 to 3 miles from Port Macquarie; capital value, £1 per acre. Available for original conditional purchase only, 10th August, 1905.

Tamworth Land District, 103 acres 2 roods 20 perches, in parish Barraba, county Darling; maximum and minimum area, 103 acres 2 roods 20 perches; price, £2 per acre. Available for original conditional purchase only on 17th August, 1905.

(Signed) EDWARD MACFARLANE,
Under Secretary for Lands.

AGRICULTURAL SOCIETIES' SHOWS.

1905.

Society.	Secretary.	Date.
Moama A. and P. Association	C. L. Blair	Aug. 9
Corowa P., A., and H. Association	F. L. Archer	,, 15, 16
Parkes P., A., and H. Association	G. W. Seaborne	,, 16, 17
Murrumbidgee P. and A. Association (Wagga Wagga)	A. F. D. White	,, 23, 24
Forbes P., A., and H. Association	N. A. Read	,, 9, 10
Gunnedah P., A., and H. Association	J. H. King	,, 22, 23, 24
Grenfell P., A., and H. Association	Geo. Cousins	,, 24, 25
Young P. and A. Association	Geo. S. Whiteman	Sept. 6, 7
Albury Annual Show	Walter J. Johnson	,, 12, 13, 14
Manildra P. and H.	E. J. Allen	,, 13
Wyalong District P., A., H., and I. Association	S. G. Isaacs	,, 5, 6
Northern Agricultural Association (Singleton)	C. Poppenhagen	,, 13, 14, 15
Yass Show	W. Thomson	,, 14, 15
Berrigan A. and H. Society	G. Hamilton	,, 20
Cowra P., A., and H. Association	F. P. Fawcett	,, 20, 21
Germanton P., A., and H. Society	Jas. S. Stewart	,, 20, 21

1906.

Albion Park A., H., and I. Society	Henry Tryer	Jan. 17, 18
Wollongong A., H., and I. Association (Wollongong)	J. A. Beatson	Feb. 8, 9, 10
Walcha P. and A. Association	S. Hargrave	Mar. 7, 8
Tamworth Agricultural Association	J. R. Wood	,, 27, 28, 29
Tenterfield Intercolonial P., A., and Mining Association	F. W. Hoskin	,, 6, 7, 8
Fair days	....	,, 9, 10
Hunter River A. and H. Association (West Maitland)	C. J. H. King	April 24, 25, 26, 27, 28
Orange A. and P. Association	W. Tanner	,, 25, 26, 27

[3 plates.]

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[ADVERTISEMENT.]

Government Stud Bulls available for lease or for service at State Farms.

Breed.	Name of Bull.	Sire.	Dam.	District where now stationed.	Lease expires.
Shorthorn ..	Royal Duke II...	Oxfords Forest King.	Royal Duchess	Singleton	5 April, '06.
,, ...	Dora's Boy ...	Cornish Boy ...	Lady Dora ..	Berry Stud Farm..	*
,, ..	Pansy King ...	Lord Sandgrave.	Pansy 4th ...	Wollongbar Exp. Farm.	*
,, ...	Fanny's King ...	Pansy King ...	Fanny ...	Manning River ...	29 Jan., '06.
,, ...	Royalty ..	....	....	Grafton Farm ...	*
Jersey ...	Melbourne ...	Woolloomooloo..	Harebell ...	Berry Stud Farm..	*
,, ...	Thessalien II ...	Thessalien ...	Egyptian Princess	Hunter River ...	1 Nov., '05.
,, ...	Golden Lord ...	Golden King ...	Colleen ...	Singleton	4 May, '06.
,, ...	Colleen's Golden Lad.	Melbourne ...	Colleen ...	Wagga Exp. Farm	*
,, ...	Coral's Lad ...	Mabel's Prince...	Coral... ...	Seven Hills ...	24 Nov., '05.
,, ...	Lord Melbourne.	Melbourne ...	Lady Tidy ...	Unanderra ..	30 Nov., '05
Guernsey ...	Calm Prince .	Rose Prince ...	Gentle ...	Dapto	1 Dec., '05.
,, ...	Gentle Prince ...	Rose Prince ...	Gentle ...	Grafton	4 Nov., '05.
,, ...	Sea King ...	The Admiral ..	Flaxy ...	Lismore	4 Oct., '05.
,, ...	Rose Prince ...	Guess	Rose Blossom	Berry Stud Farm..	*
,, ...	The Admiral ...	Hawkes Bay ...	Vivid (imp.)..	Hastings River ...	31 Jan., '06.
Red Poll ...	Dairyman ...	Dandy	Turban ...	Berry Stud Farm..	*
Ayrshire ...	Daniel	Sir Thomas ...	Craig... ...	Berry Stud Farm..	*
,, ...	Don Juan ...	....	....	H.A.College, Richmond	*
Kerry... ...	Kildare.. ...	Aicme Rex ...	Kitty ..	Berry Stud Farm..	*
,, ...	Gay Knight ...	Prince of Leinster (353).	Pansy 2nd ..	Bathurst Exp. Farm.	*
Dexter Kerry	Waterville Punch.	....	....	Grafton Farm ..	*
,, ...	Erebus	....	....	Wentworth Falls.	29 Nov., '05.
Holstein ...	President ...	Garfield ...	Nobeltje ...	Wollongbar Exp. Farm.	**
,, ...	Garfield ...	Leo 2nd... ...	Dina 2nd ...	Berry Stud Farm..	*
,, ...	Obbe II ...	Obbe	La Shrapnel...	Camden	3 Nov., '05.

* Available for service only at the Farm where stationed.
** ,, ,, or lease ,, ,, ,,

Regulations under which the Government Stud Bulls are leased.

Department of Mines and Agriculture,
Sydney, 1st July, 1903.

1. Any Agricultural Society, Dairy Farmer, or a combination of Dairy Farmers, may, should the Minister deem it advisable, obtain the hire of one of the Government stud bulls for a period of six months if they guarantee payment for the service of thirty cows, or for shorter periods on special terms.

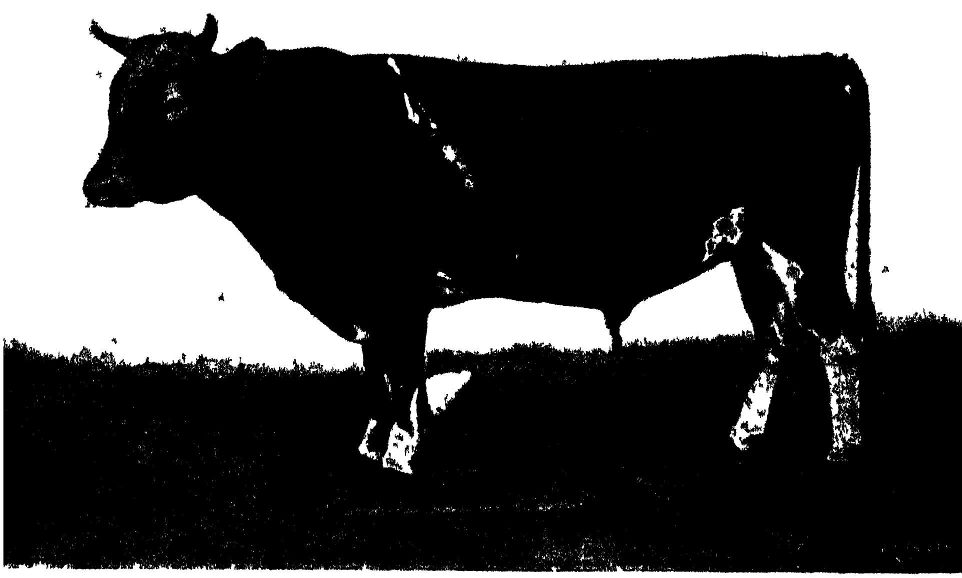
2. The fee, *which shall be payable in advance*, shall be at the rate of 5s. (five shillings) per cow for all bulls save Dexter-Kerries, and their fee shall be at the rate of 2s. 6d. (two shillings and sixpence) per cow. *Bulls will in no case be forwarded until the fees have been received.*

Agricultural Gazette of New South Wales.

State Stud Cattle Exhibited at Last Sydney Show.

M. A. O'CALLAGHAN.

THE young Guernsey bull "Calm Prince," by "Rose Prince" (imp.), from "Gentle" (imp.), is undoubtedly the handsomest of his breed born in Australia. When only a yearling an offer of one hundred guineas was made for this bull, but the Department preferred to reserve him for the use of the State as a whole He is at present leased to a farmer near Dapto.



Guernsey Bull. "Calm Prince."
By "Rose Prince" (imp.), from "Gentle" (imp.).

The shorthorn bull "Dora's Boy" is by "Cornish Boy" (imp.), from "Lady Dora" (imp.). He is a very handsome young bull of a dark red colour. His mother was one of the finest shorthorn dairy cows to be found. She is still strong and well, although fourteen years old. She yielded 421 lb. of butter in a season's milking. This bull is now doing duty at Berry State Farm.

A

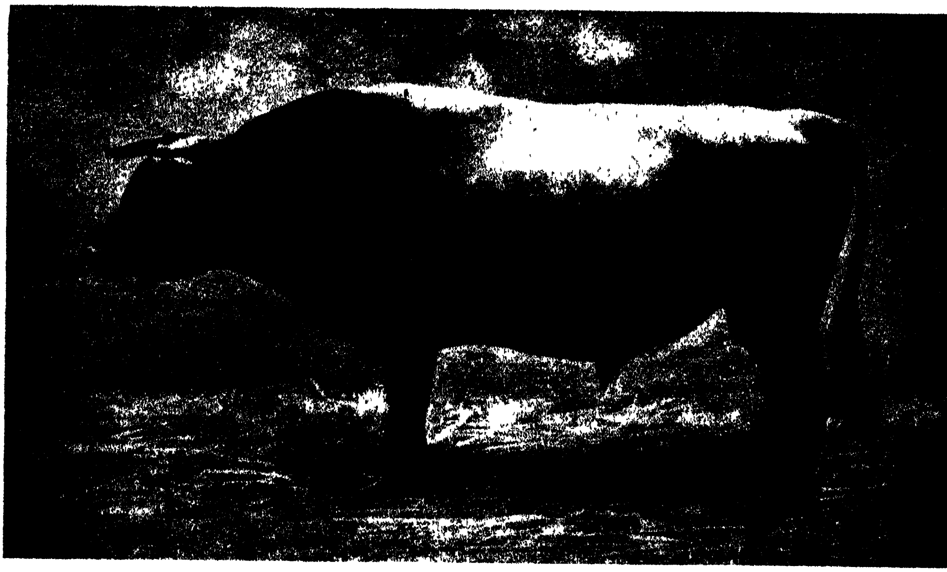
The Holstein bull "Obbe II" is by "Obbe" (imp.), from "La Shrapnel," one of the heaviest milkers of all the Holstein cows. He is a young bull of

Shorthorn Bull. "Dora's Boy."
By "Cornish Boy" (imp.), from "Lady Dora" (imp.)

Holstein Bull. "Obbe II."
By "Obbe" (imp.)

great constitution and promise, and is at present on lease to a large dairy farmer in the Camden district.

The Jersey bull "Golden Lord" is by "Golden King," from "Colleen" (imp.). He was sired in England. He is related to the famous "Golden Lad." He is a bull of wonderful constitution, with a well sprung rib of great

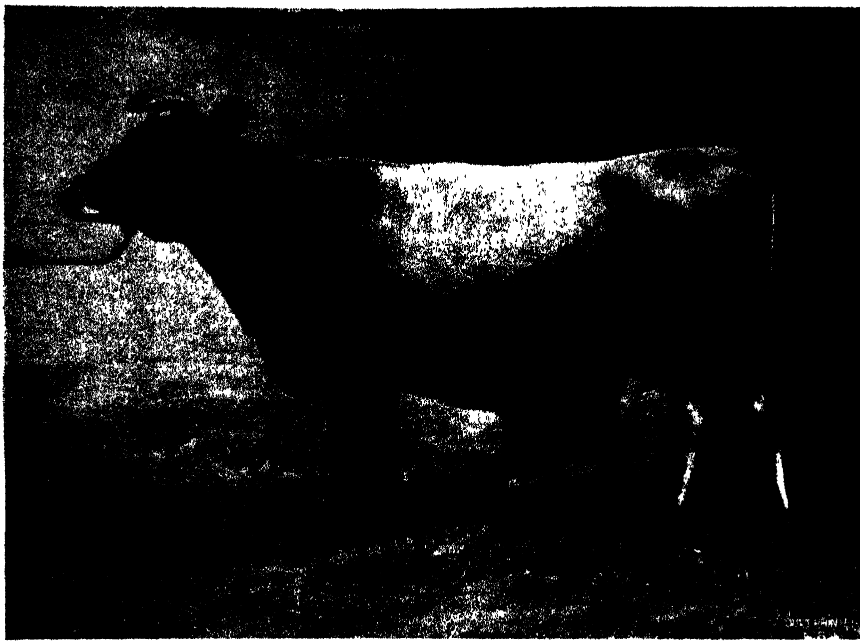


Jersey Bull. "Golden Lord."
By "Golden King" (imp.), from "Colleen" (imp.).

"Thessalian II."
By "Thessalian" (imp.), from "Egyptian Princess" (imp.).

depth. About ten applications were made to lease him on the opening day of the Show. He is now leased in the Singleton district. He is a difficult bull to photograph, and is not here seen at his best.

The young Jersey bull "Thessalian II," is by "Thessalian" (imp.), from "Egyptian Princess" (imp.). This is a bull of great quality. He is well bred for milk, and had many admirers. He is leased to a good breeder near Maitland. Like "Golden Lord," he does not like being photographed, and hence this picture does not do him justice.



Jersey Cow. "Rum Omelette" (imp.).

The cow "Rum Omelette" (imp.) is a beautiful type of Jersey. It is now over seven years since she was imported, and she has been a consistent breeder. She is eleven years old, and certainly contradicts the idea that Jersey cattle are not able to stand our coast climate. She is now heavy in calf; she has never received any special treatment, our Jerseys running under same conditions as all other breeds on the Stud Farms, never being housed save during extremely wet weather, but being rugged out of doors every winter. She is a very good milker with a high butter-fat test.

Dairy Cattle at Wollongbar Farm.

C. H. GORMAN.

FROM time to time results have been published showing the yields, etc., of the stock at this farm, but none of the progeny of the imported cattle have been available until recently. It is intended, therefore, in these articles to give the results up to 30th June, 1905, with an illustration of the dam and progeny. The first group taken are the Ayrshires, a breed that has shown itself particularly adapted to this district, and when compared with other breeds it will be found that they are not far from the premier position.

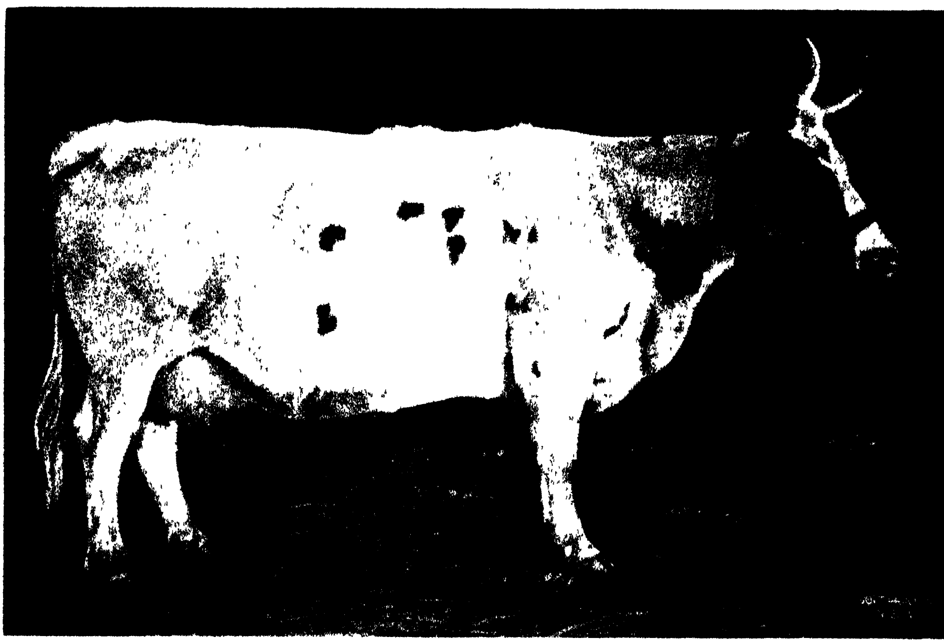


Fig. 1. "Pet Girl."

With one exception, the progeny are all by the Government imported bull, "Daniel of Auchenbrain."

Illustration No. 1 shows the cow, "Pet Girl," one of the most perfect Ayrshire cows in the State. She was bred by Mr. Sam. Hordern, and her pedigree is as under :—

Calved, 20th January, 1896.
Sire, "Hover of Southwick" (imp.), A.H.B. 2,392, vol. 13.
Dam, "Topper II."
Colour, white with brown spots.

Her best yield at this farm is the following :—In milk, 537 days, for 8,504 lb. of milk, testing on average 5·1 per cent. butter-fat, and representing 588·76 lb. milk. Unfortunately we have no Ayrshire heifers from this cow.

Illustration No. 2 shows the young Ayrshire "Daneva," by "Daniel" (imp.), ex "Eva." Unfortunately a photograph of "Eva" was not obtained, but her records and breeding may be interesting :—

Calved, 7th March, 1896.
Sire, "Hover of Southwick."
Dam, "Lady Emma IV."
Colour, red or brown, and white.

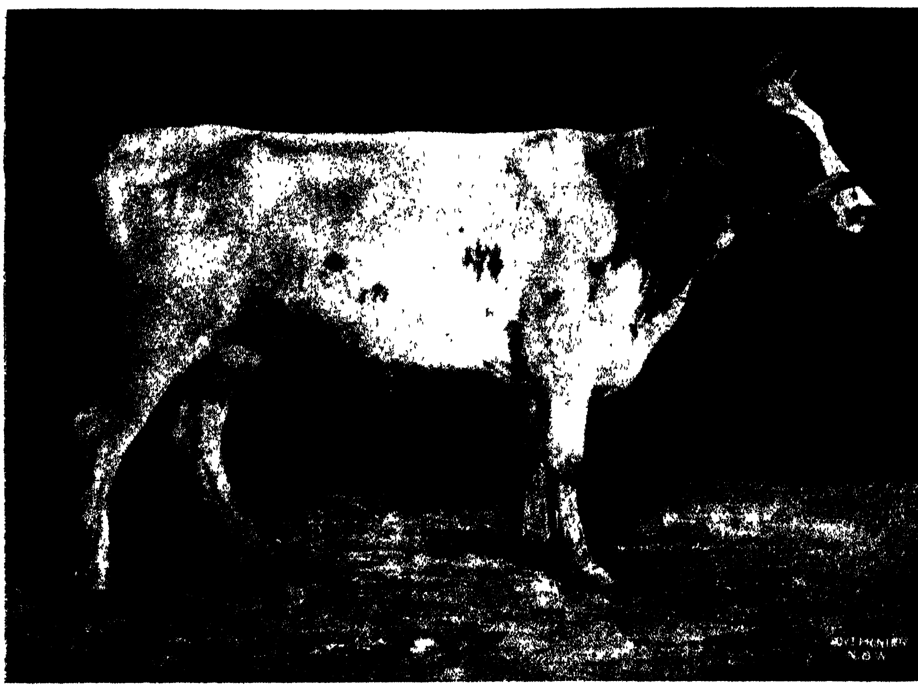


Fig. 2. "Daneva."

Eva's milking records are :—

1902. In milk, 358 days for 6,031 lb. milk, testing, on average, 5·3 per cent. butter-fat, representing 365 lb. butter.

1903. In milk, 283 days for 6,992 lb. milk, testing 5·1 per cent. butter-fat, representing 396 lb. butter.

1904. In milk, 298 days for 5,523 lb. milk, testing, on average, 5·2 per cent. butter-fat, representing 308 lb. butter.

"Daneva," it will be seen, is a beautiful type of a clean-cut Ayrshire, of good constitution, possessing all the qualifications of a first-class dairy beast. She was calved on the 28th April, 1903. Her yield up to date is as under :—

Calved, 11th March, 1905.
In milk, 107 days to date, 30th June, 1905, for 1,860 lb. milk, testing, on average, 4·4 per cent. butter-fat, representing 95·40 lb. butter.

Illustration No. 3 shows "Dot's" first calf born here, "Nada," by "Daniel" (imp.). She has beautiful teats, a well-balanced udder, good body, and an ideal colour. She was calved on the 28th March, 1903. Her record up to date is as under:—

Calved, 30th March, 1905.

In milk, 92 days to date, 30th June, 1905, for 1,964 lb. milk, testing, on average, 4·4 per cent. butter-fat, representing 102·89 lb. butter.

Fig. 3. "Nada."

Illustration No. 4 shows "Beauty," Ayrshire. She was purchased from Mr. Sam. Hordern, and her breeding is as under:—

Calved, 12th March, 1896.

Sire, "Hover of Southwick" (imp.).

Dam, "Beauty."

"Beauty's" milking records are:—

1902. In milk, 414 days for 7,598 lb. milk, testing, on average, 4·5 per per cent. butter-fat, representing 397·89 lb. butter.

1904. In milk, 273 days for 5,260 lb. milk, testing, on average, 4·3 per cent. butter-fat, representing 252·68 lb. butter.

Illustration No. 5 shows "Beauty's" first heifer calf, "Cinderella," dropped 13th July, 1902. She calved 12th March, 1905. This young cow is by Mr. Sam. Hordern's bull, "Baron Renfrew," being one of two that we have by that bull. Her record up to date is as under:—

Calved, 12th March, 1905.

In milk, 108 days for 1,993 lb. milk, testing, on average, 4·2 per cent, butter-fat, representing 97·22 lb. commercial butter to date.

Fig. 4. "Beauty."

Fig. 5. "Cinderella."

Illustration No. 6 shows "Judy," Ayrshire, a little light in colour. She was purchased from Mr. Sam. Hordern, and her breeding is as under :—

Calved, 10th February, 1897.

Sire, "Lord Raglan," A.H.B., 3,108.

Dam, "Judy 6th of Barcheskie," by "Royal Stuart," A.H.B. 2,678.

"Judy's" records at this farm are as follows :—

1903. In milk, 298 days for 5,965 lb. milk, testing, on average, 3·9 per cent. butter-fat, representing 261·04 lb. commercial butter.

1904. In milk, 270 days for 6,674 lb. milk, testing, on average, 4·1 per cent. butter-fat, representing 294·80 lb. commercial butter.

Fig. 6. "Judy."

Illustration No. 7 shows "Judy's" first heifer, "Juda," by "Daniel" (imp.), now milking, with following result to date :—

Calved, 29th March, 1905.

In milk, 92 days for 1,741 lb. milk, testing, on average, 4·4 per cent. butter-fat, representing 76·50 lb. commercial butter.

Illustration No. 8 shows "Miss Ella II," Ayrshire. She was obtained from Mr. Sam. Hordern, and her breeding is as under :—

Sire, "Hover of Southwick" (imp.).

Dam, "Eleanor of Barcheskie" (imp.), A.H.B. 7,364, Vol. 15, by "Traveller," A.H.B. 1,441.

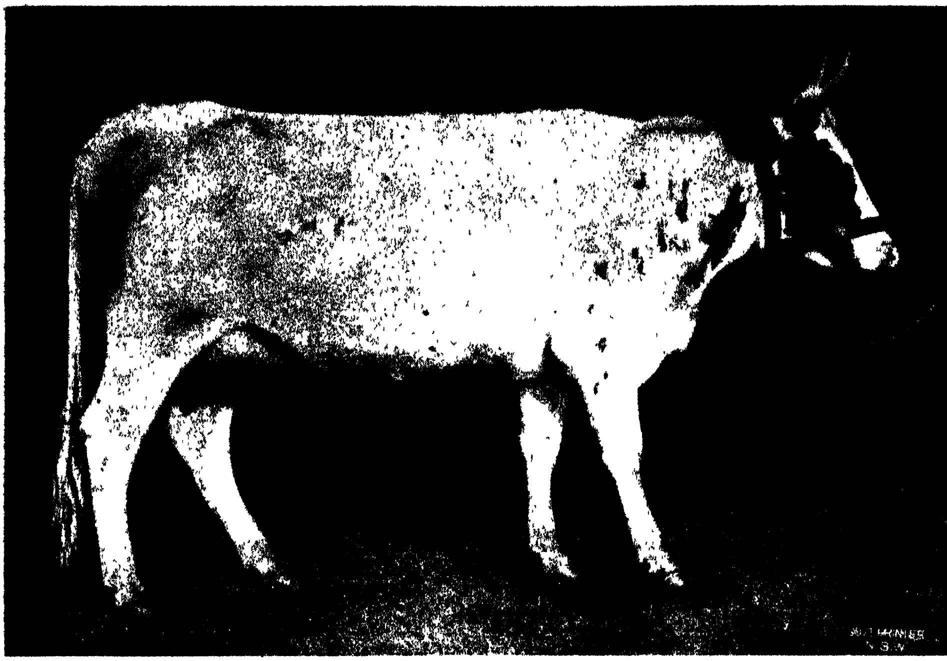


Fig. 7. "Juda."

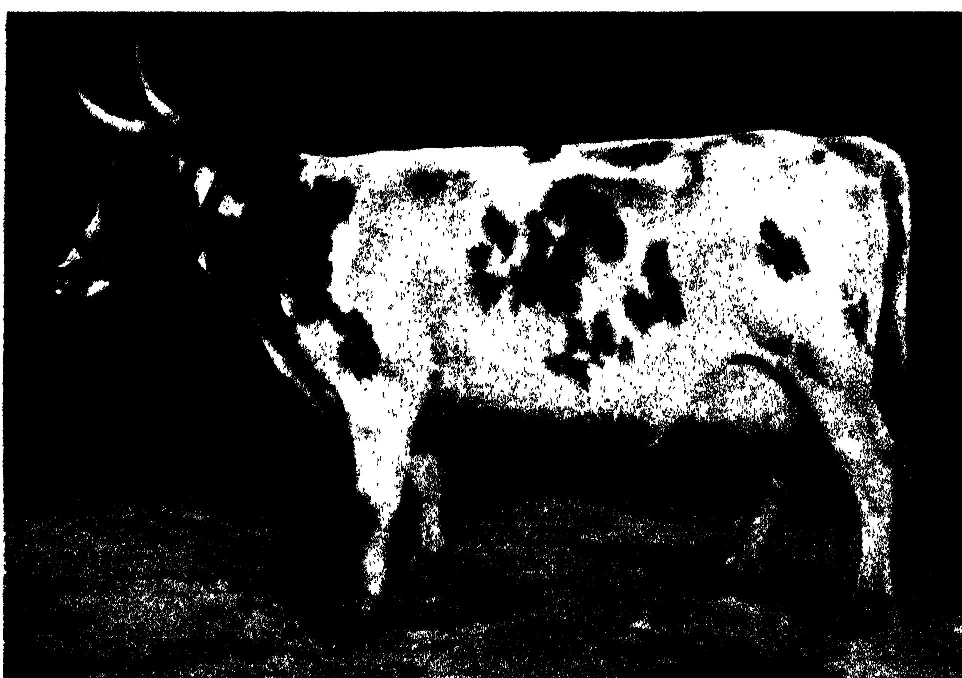


Fig. 8. "Miss Ella II."

The following are the milking records of "Miss Ella II" at this farm:

1903. In milk, 240 days for 5,099 lb. milk, testing, on average, 4·1 per cent. butter-fat, representing 242·91 lb. commercial butter.

1904. In milk, 204 days for 4,085 lb. milk, testing, on average, 4·3 per cent. butter-fat, representing 192·29 lb. commercial butter. During this period the cow was far from well, and went off her milk for some time.

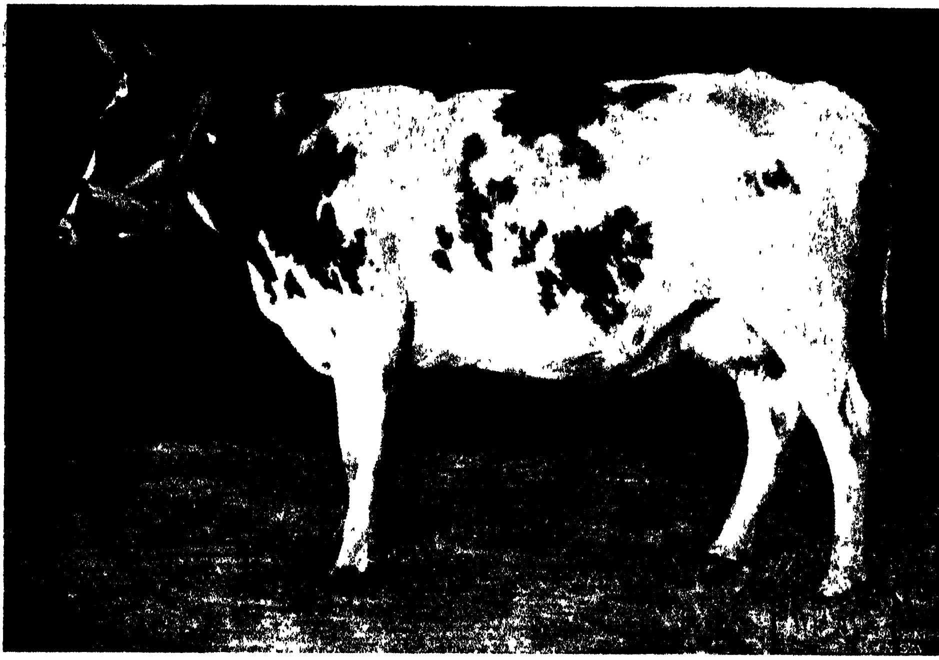


Fig. 9. "Danella II."

Illustration No. 9 shows "Danella II" heifer, by "Daniel" (imp.). Her record to date is:

Calved, 3rd March, 1905.

In milk, 120 days for 2,020 lb. milk, testing, on average, 4·3 per cent. butter-fat, representing 95·40 lb. commercial butter to date.

(To be continued.)

Cotton Seed for Distribution.

The Department of Agriculture has a small quantity of new varieties of cotton seed available for distribution, including Early Carolina, Prolific, and Extra Long Staple Sea Island, in trial packets. Application should be made to the Director of Agriculture.

Cheddar Cheese Making: Canadian System.

Hints on Cheese-making.

W. GRAHAM.

During the process of the manufacture of Cheddar Cheese, there are numerous details in connection with the work which are of vital importance, and great care and attention is required to each one during the daily routine of work, conducive to the manipulation of the finished article of good quality.

The first and important factor to the successful cheese-maker is the proper treatment of the night's milk, as when drawn from the cow it is of a higher temperature and susceptible to any bad odours that may be floating around in the atmosphere.

To avoid this, the temperature should be reduced at once; and when reduced to anything under 68° F. it may be considered safe for the night.

The amount of Acid at Setting.

The amount of acid at setting should be just enough to allow the curd time to have become firm and properly cooked, with the required amount of acid when ready to whey-off.

No hard and fast rule can be set down, for when the milk is showing a low percentage of butter-fat (say 3·2) a low percentage of acid is required, and as the period of lactation advances, and the milk becomes richer in butter-fat (say 4·0), a higher percentage of acid is required, when the curd is put to press. Thus it is, a high percentage of fat, a corresponding high percentage of casein in the milk, and it is a well-known fact that, when there is a high percentage of casein there is also a high percentage of acid in the milk when drawn from the cow. Therefore, it is necessary to adopt a sliding scale throughout the season, as in the spring of the year when the milk is low in fat less acid is required at setting, so that the curd will have had time to become firm and properly cooked, with the required amount of acid when dry on the racks, and also a fairly low acid test when put to press. And, as the season advances, and the milk becomes richer in fat, it is necessary to increase the amount of acid. A low percentage of acid in the milk, when drawn from the cow; a low percentage of acid is required when the curd is put to press. A higher percentage of acid in the milk when drawn from the cow; a higher percentage is required when the curd is put to press. If a high percentage of acid were given when the curd is put to press, with a low percentage of acid in the milk when drawn from the cow, an acidy-sour cheese will be the result.

It is, therefore, necessary to explain that acid at this stage is certainly not lactic acid, but due to acid salts. And it is generally found that the

proportion of solids in the milk is in direct relation to the proportion of casein, thus the higher the proportion of solids the higher the natural acidity of the milk.

A very good rule is to test the night's milk immediately the milk is brought into the dairy from the milking-yard (with the alkaline test), and multiply the reading by five, which will give the required amount of acid which is necessary to have in the curd when put to press. For example, the night's milk tested for acid shows ·18; the amount of acid required when putting the curd to press will be ·90. Thus it is the work through the day is regulated by setting the milk with the proper amount of acid, and also a uniformity of article is shown throughout the season.

The amount of Rennet.

The amount of rennet required at setting depends entirely upon the strength of the rennet. Sufficient rennet should be added to coagulate the milk to have it firm enough to cut with the curd-knife in from thirty to forty-five minutes. If the rennet is fresh and has not been adulterated, 3 to 4 ozs. is the amount generally used to coagulate 1,000 lb. of milk, but I have seen rennet so weak that it took 6 to 8 oz. to coagulate 1,000 lb. of milk to have it sufficiently firm to cut with the knife in forty-five minutes. Unfortunately manufacturers do not guarantee the strength of their rennet, so it is difficult to say whether it has been tampered with or not by retailers. The practical cheese-maker must be guided as to the quantity of rennet to use by the time which it takes to set the milk, and must use such quantity only as will enable him to have a nice firm curd, fit for cutting thirty to forty-five minutes after the rennet has been added to the milk.

Cooking the Curd.

When the curd has been cut with the curd-knives and a sample of whey taken and tested for acid (as per alkaline test), it will be found that the acid has considerably reduced, and is, at this stage, about two-thirds that of the mixed milk when set. It thus proves, to a certain extent, that the acid is formed in the casein in the curd, and is expelled into the whey as the cooking temperature is raised and as the cubes of curd contract.

The temperature the curd should be raised to depends upon the season of the year and the condition of the milk. Milk with a low butter-fat test should not be heated to a high temperature, else the cheese when matured will be dry and corky. The usual temperature is 98° F., but it is often found an advantage to cook as high as 100 or 102° F. in the fall of the season, when the milk is rich in fat, but it is not advisable to raise the temperature at any time higher than 104°. The curd, when ready for the whey to be drawn off, should be firm and shotty, with a sufficient amount of acid to necessitate milling in two hours—that is, after the whey has been drawn off. With the curd at the proper temperature during matting, under favourable conditions, it should be in a stringy, flaky, condition ready for milling. The amount of acid when wheying-off should be slightly more than

that which the mixed milk contained at setting, and it should be the cheese-maker's aim to have that amount of acid with the curd in a firm, shotty, condition when ready to draw off the whey.

Gassy Curds.

Gassy curds are very common in the spring of the year, and cheese-makers often find that the production of lactic acid is almost checked when the curd is in the cooking stage. If the cheese-maker has an idea or suspicion that his curd is going to develope into a gassy one, it will be found advisable not to raise the temperature when cooking the curd quite so high as he usually has to do under favourable circumstances, as the curd generally remains longer in the whey when gas is prevalent, and, consequently, becomes very firm—lactic acid does not advance so readily when the curd is firm and hard as when it is in a softer condition. It is, therefore, necessary to favour the production of lactic acid in every way, so that it will in time overcome the gas-producing organisms and expel them from the curd altogether, To do this more acid should be given before wheying-off; the curd should not be dried too much on the racks, and the temperature should be kept fairly high (94°) during the matting process. It will be found on examining the curd that small pin-holes will have formed all through the curd, The matting process should be prolonged until these pin-holes commence to flatten out, then the curd should be milled. The hand-stirring or airing the curd after milling should be continued longer, to allow the acid to develop and the gas to escape. The curd should not be rubbed with the hands or treated roughly during airing, or a heavy loss of fat will be the result when the curd is pressed; it should be spread over the bottom of the vat, about 4 inches deep, and turned over at intervals of three to four minutes. It will be found by keeping up the temperature (say 88°) whilst airing that the pin-holes will disappear altogether, thus leaving the curd in a fairly good condition and ready to salt. In this way a floating curd may be treated successfully, and by allowing sufficient time between milling and salting to elapse the curd will obtain a nice silky feeling, and a fairly good cheese will be the result.

Excess of Acid.

During the hot weather of the summer months it is often found that the milk that has been kept overnight is in an overripe condition, or, in other words, sour. The cheese-maker, endeavouring to make the best of a bad job, makes this milk into cheese, with the result that the operation is hastened from start to finish; the curd is neither properly cooked or cheddared, and the result is a leaky cheese of very poor quality.

The best way to handle milk of this description is to raise the milk to setting temperature and at once add sufficient rennet to have a curd ready to cut with the curd-knife in twenty minutes. Lose no time in raising the cooking temperature, and, while the cooking temperature is being raised, the whey should be draining off. Of course, it requires a tap or gate in the vat with a properly fitting strainer to do this. The object in draining off the

whey is to reduce the acid; as the whey is expelled out of the curd a big percentage of acid is ejected with it. It is necessary to raise the temperature of a fast-working curd higher than a normal working one. The curd must be firm and shotty before drawing the whey, and a temperature of 104° F. is necessary to do that. If the curd is taking acid too rapidly and the whey nearly all drawn off, the remainder of the firming can be done in warm water at the cooking temperature, run into the vat, and stirred amongst the curd. If the curd is still developing acid rapidly and not sufficiently cooked, the first lot of water could be run off and a fresh lot added. When the curd has reached the stage when it is firm and shotty it may be thrown on to the racks and cheddared in the usual way. Undoubtedly, prevention is better than cure, and where care and attention is exercised in the handling and cooling of the night's milk, the trouble of overripe milk will seldom occur.

Cleanliness.

Too much care cannot be exercised in keeping the factory or dairy in a clean and sweet condition. The floor of the factory should be concrete with a smooth surface. The walls inside the making-room should be kept clean and free from cobwebs and dirt spots. Where it is not possible to wash the walls an application of lime-wash is necessary. The plant should also be kept clean; the woodwork of the milk-vat and the cheese-press should be scrubbed, at least once a week, with hot water and soap or soda. Most cheese-makers are particular about keeping the inside of their milk-vat clean, but very few take the trouble to scrub the outside, and in a good many cases it presents a dirty greasy appearance. No old fat or particles of curd should be allowed to remain in the bottom of the cheese-press, and the bucket or tub catching the drip from the press should be watched closely and should be cleaned every day. All utensils, such as cheese-hoops, buckets, and strainers, should be kept thoroughly clean: avoid using any old rusty tinware. The practice of washing dairy utensils with a cloth should be avoided—always use the scrubbing-brush. It is next to impossible to wash a cloth thoroughly clean that has been once used in the dairy, therefore, avoid drying utensils with a cloth after washing; rinse with cold water after washing and place on a stand to dry. Where there are appliances for steaming milk-cans and buckets never omit to use it when washing factory utensils. The drains leading away from the factory should be watched and kept clean; avoid in every respect the possibility of any bad odours arising and contaminating the atmosphere in and around the factory. Where the factory is kept scrupulously clean it becomes an object-lesson to suppliers attending that factory. How can a factory manager preach cleanliness to his suppliers when his factory is dirty and he himself untidy in his personal appearance? The cheese-maker who pays strict attention to every little detail in connection with his work, and keeps his factory thoroughly clean, is the man who invariably becomes a success in his profession.

Introduction of Bees to Australia.

ALBERT GALE.

As a business to which a man may devote his sole attention, as a subsidiary to farming or fruit-growing, and as an addendum to pocket-money for settlers' wives, or as a pastime for persons of leisure in suburban homes, bee-keeping has nowadays throughout Australia so many votaries, that it almost goes without saying some brief account of the inception and growth of apiculture under the Southern Cross will be appreciated.

Indigenous honey-producing floræ abound both on the continent of America and in Australia, yet it is a singular fact that the most diligent search of the entomologist and other naturalists failed to discover any social honey bee having a commercial value. Certainly there is a bee of the genus *Apis* indigenous in America, but the hive bee was an introduction.

In Australia, the greatest honey insect is the so-called native bee, *Trigona carbonaria*. The native bee of America belongs to the family *Melipoma*, and does not occur elsewhere, but our native bee, *Trigona*, is found in Africa and India, as well as through Australia. The honey gathered by these native bees is variable in quality, but never equal to that of the hive bee.

It is not so very long ago, however, since "wild" honey was much sought after in our Australian bush as one of the greatest of luxuries. The fact that the *Trigona* has no sting induced many people—who would, in those days of crude, ruthless methods, have shrunk from an adventure with social honey-bees—to wage war against the stores of the "native bee." In 1822 the first hive bees were brought to this part of the world (Sydney) by a Captain Wallace, or Wallis, in the ship "Isabella," and, according to Haydon, from the bees thus introduced colonies were propagated and distributed inland among the colonists. In the *Government Gazette* of 21st June, 1822, there appeared this advertisement: —"Hive of bees for sale by Mr. Parr. Bees imported by Captain Wallace (or Wallis)." In a number of the old *Sydney Gazette*, dated Friday, 1st November, 1822, there appears this paragraph :—"We congratulate our readers upon the complete establishment of that most valuable insect, the bee, in this country. During the last three weeks three swarms of bees have been produced from two hives, the property of D. Wentworth, Esq., purchased by him from Captain Wallace, of the 'Isabella,' at his estate, Homebush, near Parramatta."

The *Sydney Morning Herald* of 10th August, 1863, says that at a meeting of the Acclimatisation Society of New South Wales, it was stated that bees were first brought to this country by Captain Braidwood Wilson, from Hobart Town,

in 1831. This was contradicted in a later issue of the same paper in these words :—"Bees were brought from England to Sydney in the year 1824, in the ship 'Phœnix,' which sailed from Portsmouth in March of that year.' This, too, is evidently a mistake, or rather another importation, as is evident from the fact that bees were advertised for sale in 1822, which has already been referred to. In 1840, a settler at Jervis Bay purchased two colonies of bees, for which he paid £4, and engaged two aboriginals to carry the hives on their heads a distance of 40 miles. These were the black or English bees, sometimes termed the German bee. For most of these dates and extracts I am indebted to Mr. S. M. Mowle, late Usher of the Black Rod, of the Legislative Council, who married the only daughter of the late Captain Braidwood Wilson, R.N.

From the foregoing small beginnings the descendants of these bees soon spread themselves fairly well over New South Wales. Of course these bees were kept in hives or boxes of any or every shape or style. The bar-frame hive was then unknown. Under the old system anyone could have bees who had the courage to rob them. The stray or escaped swarms of bees took to the bush. The aboriginals soon learned from their white brothers how to subdue bees by means of smoke, and with tomahawk and firestick, aided by strong vines, would ascend the loftiest and smoothest of trees to obtain the "white-fellow's sugar bag." The aboriginals have no word in their own language for the introduced bee. The flavour of the honey from the little native bee was no stranger to them, but they were not long in discovering that both in quality and quantity "white-fellow's sugar-bag" was far superior.

In the early seventies, so plentiful had bees become in the bush that in the old George-street Markets, dishes and buckets full of honey, mixed with dead and dying bees, dead larvæ in all stages, broken comb, and rotten wood, were exposed for sale under the cognomen of bush honey. To look at it was anything but appetising. Better samples were bottled and sold under the name of "prime garden honey."

About 1872, our bees met with an enemy that bid fair to almost exterminate them—the bee moth put in an appearance, from whence we know not. Hitherto no skill was required in the management of bees that were kept at that time. New swarms were put into a piece of a hollow log, sawn off evenly at both ends, with pieces of stringy-bark nailed over the openings, and the bees had to obtain ingress or egress as best they could. Gin cases, tea chests, or boxes of other descriptions, were preferred, but in the bush at that time these were not always to be obtained. Manipulation of these hives was as crude as the grotesquely-made hives. There was no consideration given for the lives of the bees. These early beekeepers knew little or nothing of the importance of the queen bee ; they did not understand "no queen, no bees," therefore no honey. It was a general destruction. When the bees were robbed, wax, brood, comb, and queen were all sacrificed for the honey, and the waste of the latter was almost as great in quantity as that obtained. This slovenly way of bee-keeping, combined with the ravages

of the bee moth, would have set a limit to the days of bee-keeping in this country had not means been devised to check it.

Under the foregoing adverse circumstances thinking men looked around for something that would be the salvation of the bees. It was long believed that the Ligurian or Italian bee was an insect far superior in many ways to the English bee (*Apis mellifica*). Not only was it superior as a honey-gatherer, but it was reported to be for more alert, and more persevering in resisting the attacks of enemies, more especially the bee moth which in England is known as the wax moth. So great was the onslaught with these moth pests that people owning as many as 200 colonies in a few years found themselves without a single bee. How to contend against this pest was then unknown. The bar-frame style of hive was little known, and the method of fighting the moth in the gin-case hives was an unknown quantity; and so it remains to this day. Not only were the bees that were kept in the crude methods of the day decimated by this pest, but those that had taken to bush life suffered, perhaps, to a greater extent than those more immediately under the control of man. On the Clarence River, to my knowledge, in the latter part of the sixties, it was not unusual for men to take a horse and dray and go in search of bees' nests, returning with two or three hundredweight of honey. Neither was it an unusual thing to find two or three bees' nests in the same tree. But in later years these, through the ravages of the bee moth have nearly all disappeared. From the general slaughter among the bees caused by the pest named, some few bee-keepers, with more watchfulness than others, saved a few colonies out of the general wreck. To perpetuate and multiply these was the question of questions. The Italian bee was looked to for overcoming the trouble caused by the bee moth, and enthusiastic beekeepers were not long in importing the far famed golden and dull brown coloured Italian bees.

In the *Australian Bee Manual* by Isaac Hopkins, of New Zealand, the introduction of the Italian bee in the Southern Hemisphere is thus referred to:—"It was stated by Dr. Gerstaecker that four stocks of Ligurian bees were shipped in England by Mr. J. W. Woodbury, in September, 1862, and that they arrived safely in Australia after a passage of 79 days. It does not appear, however, that these stocks succeeded and propagated any more than a colony which Mr. Angus Mackay, Editor of the *Town and Country Journal* in Sydney, subsequently brought to Brisbane, at great expense, from America. Mr. S. McDonnell, of Sydney, imported two colonies from America in 1880, and succeeded in raising stocks from them; and, later, Mr. Abram, a German bee-master, brought some colonies with him from Italy in 1883, settled in Parramatta (now of Beecroft), and, having succeeded in rearing a pure race of his queens, started an apiary for the Italian Bee-farming Company, of which he is manager, and Mr. McDonnell, Secretary." The date of the *Bee Manual* from which this is taken is 1886.

In 1882 Mr. C. Fullwood, of Brisbane, had sent direct from Charles Bianconini, of Bologna, twelve Italian queens. Of these five arrived alive, and of a second shipment in the following year seven reached their new home safely. In these early years of the introduction of the Italian bee into

Australia, the price of pure-bred tested queens, reared in the colony, was from £2 to £3 each; and I have heard that in some cases as high a figure as £5 has been asked. Of late years I have seen three advertised for 7s. 6d.

The inauguration of the Bee-keepers' Association for the assistance of amateurs, and exchange of thought and bee-keeping ideas, followed soon after the introduction of the Italian bee. The Association was based on similar lines to those established in England, which are acknowledged to have given incalculable benefit to the peasant classes in the rural districts, and the results have been equally beneficial in this State. It was never the intentions of these associations to do more than give instructions to aid people to add luxuries to their own table, in the same way as poultry-keeping, fruit-culture, kitchen-gardening, &c., is carried on, so as to expand the earnings of wage-earners, farmers' wives and daughters, and such-like.

With the pure Italian bees which were at that time expensive, came the necessity for the improvements in hives to permit of their successful and profitable management. The Langstroth simplicity bar-frame hive was welcomed as the very thing for housing these costly insects, and although there are many types of bar-frame hives available, the Langstroth still hold chief place in the esteem of up-to-date bee-keepers.

Some years ago, a disease, far more destructive to bees than the bee-moth, and now bids fair to be far more serious made its appearance amongst our bees—*Foul Brood*. On one occasion, at Bombala, I saw over 100 colonies of bees destroyed by this disease. The hives were filled with dead bees and festering foul-brood comb, thus spreading the disease far and wide, for the disease is contagious. At the present time the disease is making wholesale ravages in the western portion of this colony. Districts that were once regarded as ideal as apicultural ones are now almost swept clear of bees. Successful combating of this disease will call for considerable sacrifice on the part of apiculturists, and it is quite possible that until the enactment of special legislation for the control of the disease, the gravity of the matter may escape the attention it demands. When every keeper of bees, be it but a single hive or an extensive apiary, earnestly sets about acquiring a knowledge of the character of the disease and of the causes that are conducive to its spread, and co-operation with his bee-keeping neighbours and the Association in suppressing it, the bee-keeping industry will be freed from a disaster that threatens to overwhelm it.

The end of the nineteenth century has seen almost the entire abolition of the wasteful and barbarous methods of bee-keeping in logs, straw skips and gin cases. During the three-quarters of a century that hive bees have been kept in Australia, the average yield per hive has been raised nearly fourfold. The tainted, unproductive, or drone laying queen can, at the present time, be replaced at extremely small cost by a tested one of unquestionable merits and quality, and with no more trouble than that involved in the forwarding of a letter through the post. The vindictive bee, in its inaccessible home, has been replaced by a docile creature living in a dwelling entirely under observation,

and safe to close scrutiny. The century just closing has given birth to many valuable inventions, and that of the bar-frame hives, with means and knowledge to subdue the irritability of bees, and to "manufacture" queen bees "on the shortest notice" as well as to keep the inmates of the hive in subjection, takes prominent place. For diseases and enemies in and among bees, be it moth or bacillus, there is but one remedy, and that is prevention. A numerically strong colony, a queen of active strain, and a scrupulously clean hive, are the barriers that, universally adopted, will keep all bee troubles at bay.

Butter Over-run.

In accordance with my promise, I now give the results of your tests of my cream as sent to you; but before entering into same, I must tender you my thanks for the trouble given to satisfy me as to the accuracy of the factory results, which will speak for themselves. During the month of April I had reason to suspect the accuracy of the factory, as my test and the manager's did not agree to the extent of 40 lb. of butter for the month; hence my appeal to you for an independent test. At the same time, yours and mine were, with few exceptions, the same, the difference being at most about 5 lb. in 1,194 lb., the factory being 63 lb. short of the Department's, and 58 lb. in mine. The results I give you on another sheet; and again thanking you, I hope many more farmers will test their cream, for their own benefit. Upon going into the matter, I found the test was performed in a perfunctory manner. Only one cup was used for all creams, so that the low-grade cream would benefit at the cost of the higher grade, and *vice versâ*. Since I have have had my cream tested from a clean vessel, my test and the factory's have been uniform. I mention this that other farmers who read the *Gazette* may see that their cream is treated with a reasonable amount of accuracy. If I am wrong in my working of results, I would thank you to say so.

	Cream.	Test.	Commercial Butter.
	lb.		lb.
2 May	166	46·	92·96
5 ,, ...	218	44·	116·41
8 ,, ...	179	54·	118·85
11 ,, ...	175	55·	118·47
13 ,, ...	117	52·	74·64
16 ,, ...	166	52·	105·90
19 ,, ...	169	49·	101·23
22 ,, ...	185	45·	101·19
25 ,, ...	293	46·	108·08
27 ,, ...	152	43·	79·19
29 ,, ...	152	43·	79·19
31 ,, ...	184	44·	98·25
			1,194·36
	Factory return		1,131·00
	Butter short		63·36

Pot Experiments to Determine the Limits of Endurance of Different Farm-Crops for Certain Injurious Substances.

F. B. GUTHRIE AND R. HELMS.

PART III.—BARLEY AND RICE.

THE experiments which form the subject of the present communication were carried out last year and are in continuation of those already communicated to you with regard to wheat and maize. They were conducted in precisely the same manner, and it will be unnecessary to go into details concerning the methods adopted, which will be found in full in the *Agricultural Gazette,* February, 1903, page 114, and January, 1904, page 29.

The soil with which the pots were filled was a rich garden loam mixed with a nearly equal quantity of light sand. Each pot received a manuring of 10 grms superphosphate, and all were exposed to precisely the same conditions as to light, warmth, water, etc., throughout the course of the experiment. Check-pots were filled and sown in exactly the same way, except that the deleterious substances were omitted.

III.—BARLEY.

Experiments with Common Salt.

Eight pots were filled with the soil together with a light manuring with superphosphate and the following quantities of common salt per 100 lb. of soil:—

No. 84, ·10 per cent, NaCl.		No. 88, ·30 per cent. NaCl.	
„ 85, ·15	„ „	„ 89, ·35	„ „
„ 86, ·20	„ „	„ 90, ·40	„ „
„ 87, ·25	„ „	„ 91, ·50	„ „

The pots were sown on December 3rd, 1902, with 13 grains of barley in each pot, the surface being covered as in the other experiments with a mulch of shredded coconut fibre, and the soil kept moist during the experiment.

The following notes were made on December 13th with regard to the growth of the plants: –

In No. 84 the seeds had germinated well, but the growth had already been affected.

In Nos. 85 and 86, the plants had germinated weakly and the growth was very poor. In the remaining pots the seed had not germinated at all.

From these experiments it would appear that the limits both to growth and germination had been struck, the growth being affected by ·10 per cent. NaCl and the germination at about ·25 per cent.

Further pots were sown on July 30th, 1903, with the following quantities of salt :—

No. 92, ·05 per cent.	No. 94, ·10 per cent.
„ 93, ·07 „	„ 95, ·15 „

These were examined on August 21st, 1903, when the following notes wer made :—

No. 92, germination and growth unaffected.

No. 93, germination unaffected, growth very slightly affected.

No. 94, the germination had been slightly affected and the growth retarded.

No. 95, germination was weak and the growth was poor.

Examination of the pots a month later, September 29th, 1903, showed that in pot No. 92, the growth was quite unaffected and the plants were growing vigorously.

In Nos. 93 and 94, the plants had recovered and were apparently as healthy as the control pots, whereas in pot No. 95 the growth was affected.

From the above it is concluded that the germination of barley is affected by about ·1 per cent. NaCl, and entirely prevented by the presence of ·25 per cent. The growth is affected by as little as ·07 per cent. NaCl, but with this quantity and up to ·15 or ·20 per cent. the plants may recover under favourable conditions. With ·20 per cent. the growth is prevented.

Experiments with Sodium Carbonate.

Eight pots were filled with soil, manured with superphosphate and sown on December 3rd, 1902, with 13 grains of barley. Sodium carbonate had previously been added in the following proportions:

No. 96, ·1 per cent. Na_2Co_3.	No. 100, ·35 per cent. Na_2Co_3.
„ 97, ·2 „ „	„ 101, ·40 „ „
„ 98, ·25 „ „	„ 102, ·50 „ „
„ 99, ·30 „ „	„ 103, ·60 „ „

The appearance of these pots on December 13th, when they were examined, was as follows :—

Germination had not been affected in pots 96 and 97.

In pot 98 the germination had been slightly retarded, though all the seeds had germinated.

In the remaining pots the germination was less vigorous, and in pot 103 the seeds did not germinate at all.

In pot 96, the plants were growing well. In 97 the growth was slightly affected, the effect increasing with increase of sodium carbonate up to pot 101. In this and the succeeding pots the plants had died.

In order to determine within narrower limits the point at which the growth commenced to show signs of being influenced by the presence of carbonate of

soda, three additional pots were sown on July 30th, 1903, containing respectively :—

No. 104, ·1 per cent. sodium carbonate.
„ 105, ·15 „ „
„ 106, ·2 „ „

On August 21st, 1903, when these pots were examined, the germination was unaffected in all three. In pot 104 the growth was quite vigorous and unaffected; in No. 105 the growth was slightly affected, and in No. 106 somewhat more so.

From the above it is concluded that germination of barley is not affected by quantities of carbonate of soda up to ·25 or ·30, and is absolutely prevented by ·60 per cent. carbonate of soda in the soil. The subsequent growth of the plant is not affected by quantities below ·15 per cent., at which point the effects of carbonate of soda are distinctly noticeable. ·4 per cent. and over prevent the growth of barley.

Experiments with Ammonium Sulphocyanide.

Six pots were filled and sown on December 3rd, 1902, as in the preceding experiments, the following quantities of ammonium sulphocyanide having been added previous to sowing :—

No. 107, ·001 per cent. NH_4CNS. No. 110, ·004 per cent. NH_4CNS.
„ 108, ·002 „ „ „ 111, ·005 „ „
„ 109, ·003 „ „ „ 112, ·006 „ „

In all these cases the germination was unaffected and the plants were growing vigorously on December 13th in all pots except Nos. 111 and 112, in which the growth was affected.

Another series of 5 pots was sown on July 30th with freshly-prepared ammonium sulphocyanide, as the solution of cyanide used in the above series had been in stock for some time, and it was thought probable that it had undergone decomposition.

No. 113, ·007 per cent. ammonium sulphocyanide.
„ 114, ·008 „ „ „
„ 115, ·009 „ „ „
„ 116, ·010 „ „ „
„ 117, ·012 „ „ „

In none of these cases did the plants germinate, the results are consequently inconclusive and the experiments will have to be repeated.

Experiments with Sodium Chlorate.

Pots were filled as follows :—

No. 118, ·001 per cent. sodium chlorate.
„ 119, ·002 „ „
„ 120, ·003 „ „
„ 121, ·004 „ „
„ 122, ·005 „ „
„ 123, ·006 „ „

All pots germinated well, except Nos. 122 and 123 in which the germination was much retarded, and the plants very weak. On December 13th, the plants in Nos. 118 and 119 were growing well when examined. In No. 120 the growth was good, but the leaves had a tinge of yellow at the tips.

In 121 and 122 the growth was markedly affected, and in 123 the plants were dying. In these three last pots the leaves were distinctly yellow.

Three additional pots were sown on July 30th, 1903, with larger preparations of chlorate:—

No. 124,	·006	per cent.	sodium chlorate.
„ 125,	·007	„	„
„ 126,	·008	„	„

In none of these cases did the plants germinate.

It appears from the above that in the case of barley, germination is affected by the presence of ·005 per cent. sodium chlorate in the soil, and entirely prevented when ·006 or ·007 is present. The effect of this substance is apparent when ·003 per cent. is present, and when it reaches ·006 the growth of barley is prevented.

Experiments with Arsenious Acid.

Six pots received varying proportions of arsenious acid on December 3rd, 1902, as follows:—

No. 127,	·10	per cent.	As_2O_3.	No. 130,	·40	per cent.	As_2O_3.
„ 128,	·20	„	„	„ 131,	·50	„	„
„ 129,	·30	„	„	„ 132,	·60	„	„

All plants germinated fairly well, but the growth was found (December 13th, 1902) to have been affected by the smaller quantity of arsenic taken No. 127 being very slightly affected. No. 128 was slightly affected, and in No. 129 the growth of the plants was much affected, the effect being more marked with the increase of arsenic in the remaining pots.

Additional pots were re-sown on July 30th, as follows:—

No. 133,	·05	per cent	As_2O_3.
„ 134,	·06	„	„
„ 135,	·10	„	„

When examined on August 21st, 1903, the germination was practically unaffected in all cases, but the effect on the growth was already strongly marked in the case of No. 133. In No. 135 the growth was very strongly affected. By September 29th, 1903, when the pots were again examined, pots 133 and 134 had recovered and were growing vigorously though not quite as strongly as the control pot. In No. 135, however, the plants were almost dead.

The results with barley are tabulated below :—

EFFECT upon germination and subsequent growth of Barley of different percentages of injurious substances in the soil.

	Germination affected.	Germination prevented.	Growth affected.	Growth prevented.
NaCl	·1	·25	·10	·20
Na_2CO_3	·25	·60	·15	·40
NH_4CNS...	Inconclusive.	....	....	....
$NaClO_3$	·005	·007	·003	·006
As_2O_3	....	Germination unaffected by ·6	·05	·10

IV. RYE.

Experiments with NaCl.

Five pots were filled with soil, to which was added 10 grms superphosphate per pot, and the following quantities of sodium chloride :—

No. 136, ·05 per cent. No. 139, ·20 per cent.
„ 137, ·10 „ „ 140, ·25 „
„ 138, ·15 „

These pots were sown on August 6th, 1903, in the usual manner, the surface being covered with a mulch of shredded coconut fibre and the soil kept moist throughout the experiment. A check-pot was sown at the same time.

The pots were examined in August 21st, when the following observations were made :—

In No. 136, the plants had germinated well, but the growth was rather backward compared with that in the check-pot.

In No. 137, the germination was already affected and the growth considerably retarded.

In the remaining three pots both germination and subsequent growth were very markedly affected.

The pots were again examined on September 29th, 1903, when it was found that the plant in pots 136 and 137 had recovered and were apparently making as vigorous growth as the check-pot. In pot 138, however, the growth was strongly affected. In pot 139 the plants were nearly dead, and in No. 140 they were quite dead.

These experiments showed that germination of rye is already affected by the presence in the soil of ·1 per cent. NaCl, it was not, however, prevented by amounts up to ·25 per cent. The subsequent growth of rye is affected by ·05 per cent., but under favourable conditions the plants may recover in the presence of sodium chloride up to ·1 per cent. With ·15 per cent. the subsequent growth is strongly affected, and with ·20 per cent. the plants die.

In order to ascertain the amount necessary to prevent germination, a further series of four pots were sown on October 10th, 1903, with the following proportions of common salt:—

No. 141, ·30 per cent. NaCl.	No. 143, ·40 per cent. NaCl.
„ 142, ·35 „ „	„ 144, ·50 „ „

It was found on examining these pots on October 21st that the germination in Nos. 141 and 142 had been strongly affected, and that in No. 143 the plants had hardly germinated at all, the germination being still more feeble in No. 144.

By December 4th the plants in all pots were dead. Germination of rye is therefore prevented by ·4 per cent. NaCl and over.

Experiments with Na_2CO_3.

On 6th August, 1903, six pots were filled with the soil, 10 grms superphosphate to each pot, and the following quantities of sodium carbonate, and thirteen grains of rye—

No. 145, ·1 per cent.	No. 148, ·30 per cent.
„ 146, ·2 „	„ 149, ·35 „
„ 147, ·25 „	„ 150, ·40 „

The following notes were made on August 21st:—The germination was unaffected in pots 145 and 146; slightly affected in 147, and more strongly in the remainder. The early growth was slightly affected in pots 145, 146, 147, and more strongly affected in the remaining three.

On September 29th, the plants in 145, 146, and 147 had recovered and were growing as vigorously as the check-pots; in No. 148 the growth was strongly affected, in 149 the plants were very feeble, and in 150, very nearly dead.

In order to arrive at the point at which germination was prevented, three more pots were sown on October 10th, as follows:—

No. 151, ·4 per cent. Na_2CO_3.
„ 152, ·45 „ „
„ 153, ·50 „ „

On October 21st the germination in pot No. 151 was strongly affected; in pot 152 the germination was still more strongly affected, and in pot 153 the plants had hardly germinated at all. By December 4th, 1903, when the pots were again examined, the plants were all dead.

It is, therefore, concluded that in the case of rye, germination is affected by the presence of ·25 per cent. Na_2CO_3, and prevented when ·5 per cent. is present; ·1 per cent. is sufficient to check the early growth of the plant, but under favourable conditions the plants will recover with quantities up to ·25 per cent.; above this point, however, the subsequent growth of rye is affected, and in the presence ·4 per cent. the plants die.

Experiments with Ammonium Sulphocyanide.

The following pots were prepared and filled with soil as usual, manured, and sown on August 6th, 1903 :—

No. 154, ·004 per cent. NH_4CNS.
,, 155, ·005 ,, ,,
,, 156, ·006 ,, ,,
No. 157, ·007 per cent. NH_4CNS.
,, 158, ·008 ,, ,,

The pots were examined on August 21st, when it was found that in all cases the germination was very weak and the young shoots had withered almost as soon as they appeared above ground.

The pots were consequently resown on October 10th with the following quantities:—

No. 159, ·001 per cent. NH_4CNS.
,, 160 ·002 ,, ,,
No. 161, ·003 per cent. NH_4CNS.
,, 162, ·004 ,, ,,

On examining these pots on October 21st, it was found that the germination was unaffected in all cases. Pots 159 and 160 were growing well, but the growth was affected in No. 161, and more strongly in 162, the leaves beginning to curl and the tips to wither.

On December 4th, when re-examined, all plants had apparently recovered and were doing well. The results therefore with ammonium sulphocyanide are not conclusive and will require to be repeated. Germination appears to be affected by quantities above ·004 per cent. and the growth of the plants affected by ·003 per cent., with this quantity and up to ·004 the plants may recover under favourable conditions. Above ·004 the plants do not recover.

Experiments with Sodium Chlorate.

The following pots were prepared and sown on August 6th, 1903, sodium chlorate being applied in the undermentioned quantities:

No. 163, ·002 per cent. $NaClO_3$.
,, 164, ·003 ,, ,,
,, 165, ·004 ,, ,,
No. 166, ·005 per cent. $NaClO_3$.
,, 167, ·006 ,, ,,

The pots were examined on August 21st, when it was found that pots 163 and 164 had germinated well. In 165 the germination was slightly affected, and in 166 and 167 the germination was very weak - in pot 167 the plants hardly germinated. In all cases, even in pots 163 and 164, the subsequent growth was very feeble and the plants were nearly dead. In pots 166 and 167 the plants were quite dead.

Two more pots were, therefore, sown on October 10th, with smaller quantities of $NaClO_3$, in order to determine the point at which the growth commenced to be affected.

No. 168, ·001 per cent. $NaClO_3$.
,, 169, ·002 ,, ,,

These pots were examined in October 21st, when both had germinated well. In pot 168, the growth was unaffected, and in No. 169 the growth was slightly affected. By December 4th, when the pots were again examined, the plants in both cases had recovered and were growing well.

From these it is concluded that germination is unaffected by $NaClO_3$ in the case of rye by quantities below ·004 per cent., the presence of ·006 per cent, preventing germination. The subsequent growth of the plants is affected by ·002 per cent., but under favourable conditions the plants can recover. Growth is prevented by ·004 per cent.

Experiments with Arsenious Acid.

The following 5 pots were filled with soil, manured, and sown on August 6th with varying quantities of arsenious acid :—

No. 170, ·05 per cent. As_2O_3.
,, 171, ·10 ,, ,,
,, 172. 20 ,, ,,
No. 173, ·30 per cent. As_2O_4.
,, 174, ·40 ,, ,,

When examined on August 21st, the following appearances were noted :—In pots Nos. 170 and 171 the plants germinated freely. In 172 the germination was retarded. In 173 and 174 the germination was very feeble, and in No. 174 the plants had hardly germinated at all. The plants were growing well in No. 170, but the growth was already affected in No. 171, and in the remaining pots the plants were very feeble, and in 173 and 174 nearly dead.

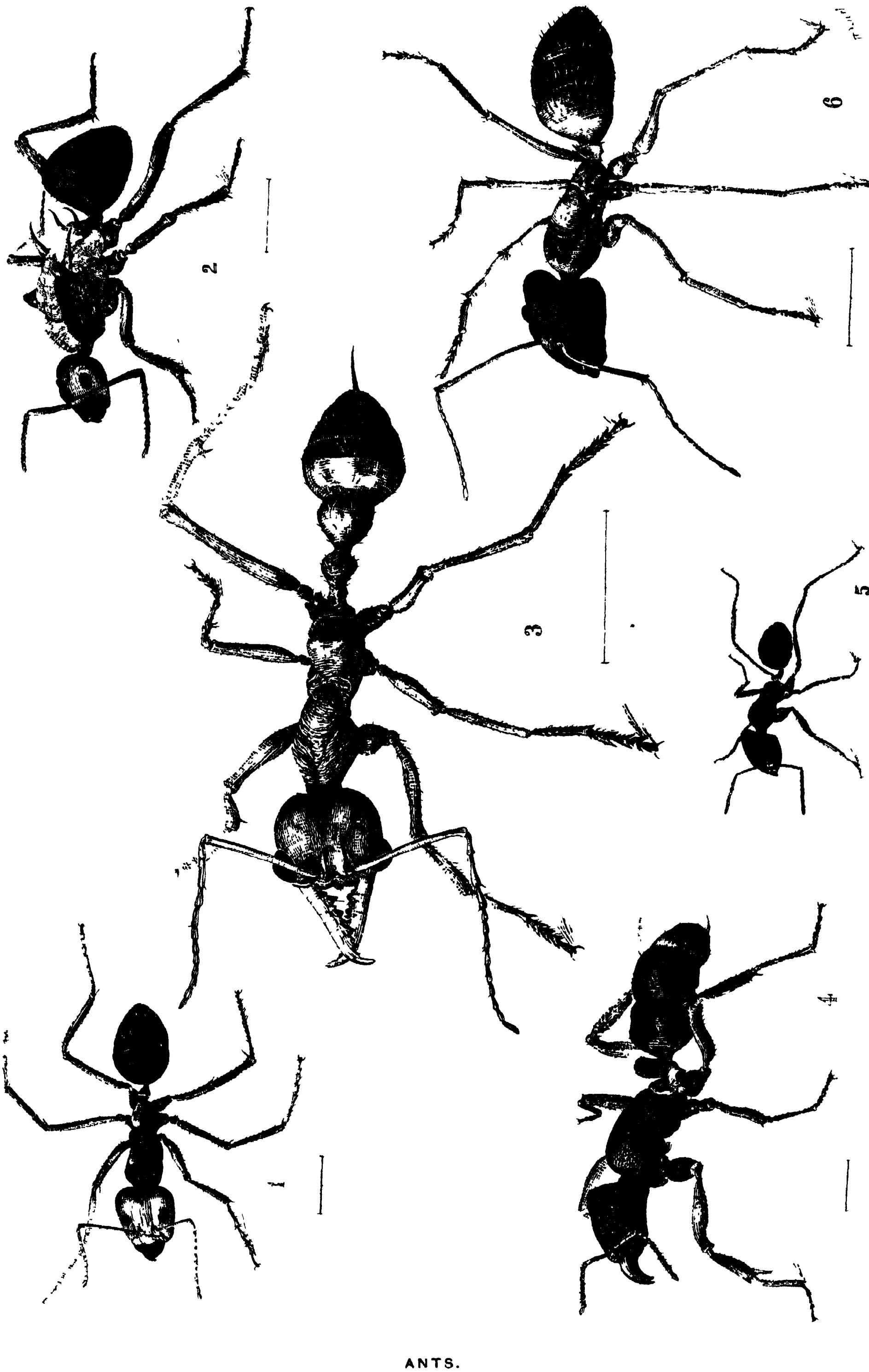
Subsequent examination of the pots on October 10th showed the plants in No. 170 to be growing normally, and equal to the check-pots The plants in No. 171 had recovered, and were apparently quite as healthy as those in the check-pots. In No. 172 the growth was affected (stunted) and in 173 and 174 the plants were dead.

The conclusions drawn are that germination in the case of rye is unaffected by quantities of arsenic below ·2 per cent. With ·2 per cent. germination is affected, and about ·4 or a little over prevents germination. The subsequent growth of rye is not affected until the amount of arsenic in the soil reaches ·15 per cent. at which point the effects of its presence are marked, and with ·30 per cent. the growth of rye is prevented.

The results of the experiments with rye are presented in the following table :—

EFFECT upon germination and subsequent growth of Rye of different percentages of injurious substances in the soil.

	Germination affected.	Germination affected	Growth affected.	Growth prevented.
NaCl	·10	·40	·15	·20
Na_2CO_3	·25	·50	·25	·40
NH_4CNS	inconclusive	......	...	...
$NaClO_3$	·004	·006	·002	·004
As_2O_3	·2	above ·4	·15	·30



ANTS.

1 *Mound Ant (Iridomyrmex detectus)*
2 *Golden Wood Ant (Polyrhachis semiaurata)*
3 *Red Bulldog Ant (Myrmecia gulosa)*
4. *The Green Head (Ectatomma metallicum).*
5. *Common Black Ant (Iridomyrmex rufoniger).*
6. *Sugar Ant (Camponotus nigriceps).*

Domestic Insects: Ants.

WITH CATALOGUE OF AUSTRALASIAN SPECIES.

WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

AUSTRALIA is an ideal place for ant life; a warm, almost frostless, climate, for the cold is never so intense that it reaches down into the subterranean homes of the ant world. Safe underground, they can lay up through the short winter months free from all the ills to which the less fortunate insects above ground are exposed. Therefore there are fewer checks to their increase than in most lands, and with the first warm weather they swarm out from all quarters; while in the more northern latitudes they are always in evidence. Wherever one goes he will find some species of ants, though they are usually more plentiful in hilly or forest country, than open plains or river flats.

The difficulties that the housewife in the bush has to contend with are multitudinous in comparison with those of her sister in the city, but none is more annoying than the ant worry, though we sometimes have it in a minor degree in the city and suburban homes. In most bush homes you will find the family safe standing well away from the wall with each leg resting in a sardine-tin half-full of water, or a band of opossum skin tied tightly round each, if they are not treated with tar or encircled with a broad belt of chalk, but these safeguards have to be constantly looked after, for if the water gets choked with dirt or dries up, or the bands get displaced, some wandering ant soon finds it out and passes word on to his clan, and before one can stop it the safe is stormed and the eatables are attacked.

The bushman in camp has a simple meat-safe formed out of a corn-sack which, hung up from a neighbouring branch by a couple of wires attached to the sides, with the lower side spread out with a flat board and the mouth tied with a string, forms a safe place for his food supplies from all prowling creatures except the ants, but he stops them by breaking two beer bottles and using the neck part as a funnel through which he passes the suspending wires, plugging the neck with a cork, and filling them with water, thus cutting off the marauding hosts that would otherwise swarm down.

Many inquiries are made every season as to the best methods of getting rid of the small black ants that get into every kind of food; but unless one can find their nests, which are often hidden away about the foundations of the house, it is simply a matter of perseverance, and constantly waging war upon them until the survivors retreat.

Where nests are found a liberal dose of kerosene will settle them very quickly, but in the house bits of bread or cake that have been sugared placed

in their line of march attracts them, when they can be regularly picked up and dropped into a tin of hot water, or oil and water, the baits being renewed; it is often a slow process but if persevered in is sure.

When the mound ant invades the garden and begins burrowing in the paths and lawns, or is too handy to the house, bisulphide of carbon is the quickest method of exterminating them in one act, and also shatters the underground workings so badly that no fresh colony can take up the empty quarters. The best method of using bisulphide of carbon is to first plug up all but half-a-dozen of the main shafts leading downwards, then pour about a large tablespoonful of bisulphide down each of the openings, and throw a damp bag over the top, which drives the heavy fumes downwards, these soon sink into every gallery in the ground; then in about two minutes pull the damp bag off and apply a lighted match at the end of a short stick to each aperture, when the gas rising upwards, catches fire and ignites down to the bottom of the nest killing everything, the concussion breaking up the galleries and cracking all the surface, but there is no danger to the person operating. This is also a very good method of dealing with the smaller nests of the bull-dog ants when they are found near the homestead.

I treat the bull-dog ants as domestic insects as they are such aggressive creatures that they often wander into the house in the bush and attack anybody that they come across.

The Little Red House Ant (Monomorium pharaonis, *Linn.*).

This tiny little ant, which was introduced into Australia at a very early date, builds its nest in the floors and walls of houses, and is a very difficult pest to get rid of unless the nest can be located and destroyed, which is usually a difficult matter in a large house. It is well domesticated in some Sydney houses, but nothing like so bad as in Brisbane and the coastal towns of Queensland, where even in many of the large hotels one cannot leave anything about on the dressing-table without them swarming over it, and even the water bottles have to be placed in a saucer full of water to keep them from crawling into the neck. This little pest is almost world-wide in its range over Europe, Asia, Africa, and America; and has been re-described by various writers under a number of different names, since Linné named it in 1758. It measures under one-twelfth of an inch in length, and is of a uniform dull reddish-brown colour.

The Common Black Ant (Iridomyrmex rufoniger, *Lowne*).

This is the ant that is so troublesome in Sydney houses in summer-time, swarming in over the window-sills or any crack or crevices in the walls or floor, getting into all kinds of food, and having a very objectionable smell when crushed. Forel has made a new variety of this species which he calls *domesticus* from its house-loving proclivities. In its native state it builds its nest under bark on tree-trunks, under stones, and such-like places, forming large colonies, which in the early part of the year will be found full of larvæ and pupæ in all stages of growth. When they come about the house they

are fond of getting under the shelter of a wall, or working out a passage between the bricks or tiles. The genus *Iridomyrmex* is also represented in Central America, Asia, and some of the Islands, but Australia is its stronghold, for out of twenty-one described species over half of them are peculiar to this country.

The Mound Ant (Iridomyrmex detectus, *Smith*).

This is one of the largest species of the genus, and is popularly known in the bush as the "meat ant," though omnivorous in their habits and storing up all kinds of food in their nests. They always find out fresh meat or offal about a camp, and where sheep have been worried by dogs and died in the scrub I have seen great holes excavated in the carcass and strings of ants carrying off bits of flesh in their stout jaws; I also knew a man, who in a fit of the "horrors" climbing up a tree—probably under the idea he was an opossum—fell down into one of their nests where he remained insensible for some time, and when found had the tip of his nose and portions of his lips gnawed away by those ants. In museum collections this ant is better known under the name of *Iridomyrmex purpureus*, as Smith described the female under this name, at the same time naming the male form *I. detectus*. These ants construct very extensive nests, forming large mounds several yards in circumference, and often raised several feet above the surface, through the excavated soil being brought to the surface. From the rounded summit many vertical circular shafts lead downwards into the net-work of galleries and irregular chambers beneath, tenanted by countless thousands of busy workers, winged males, females, pupæ, and larvæ in all stages of growth. At the least disturbance the workers swarm up through the openings biting with their stout jaws at any strange object they find trespassing in their domain, and though not furnished with a sting, can bite very sharply with their powerful nippers and make themselves very unpleasant. In the forest they have regular beaten tracks leading out from the nests quite bare of grass through the myriads of tiny feet constantly passing backwards and forwards. During the long-continued drought in the interior, I am told they have greatly increased in numbers, and on a recent visit to the Darling River country I noticed their nests, scattered all over the country—usually much more raised and conical than those in the coastal districts.

It is puzzling to understand how such immense numbers of these insects find enough food to maintain the life of these nests, for in many districts every tree-trunk is covered with columns of them hunting all over branches where everything seems to be fish that comes to their net, as they get the honeydew from the aphids and froghoppers, hunt over the orchard trees for exudations of all kinds of scale insects, which by their presence, they protect to a certain extent from their numerous enemies, and are therefore no friends to the gardener; some orchardists go so far as to say that they carry scale and aphids from dirty to clean trees, but if they do it is probably unintentionally—the larval insect has simply taken a free ride. When they settle down and form a nest in a lawn or garden path they are a great nuisance,

and have to be driven out. The workers (which are the only forms in evidence) measure slightly over one-fourth of an inch in length, and are of a general reddish-brown tint, except the abdomen which is blackish, shiny, clothed with very fine hairs which are not noticeable unless examined under a lens. The head and thorax, viewed in a bright light, have a rich purple sheen. The winged males and females are much larger with well-developed wings, and can be generally found in the galleries near the summit of the nest.

The Green Head (Ectatomma metallicum, *Smith*).

This is one of our commonest species, being as common in the garden as it is in the bush, and constructing similar nests in both places, though in the bush the nests are more regular in form, as they are excavated under logs or stones into galleries or chambers. The communities are usually small, sometimes consisting of only a few dozen. The pupæ are enclosed in a stout brown cylindrical cocoon. This is the ant that so often stings one in the garden, when you are sitting about on the lawn or grass plots; but though a very unpleasant sensation at the moment it is not a very serious thing to the ordinary person. The "green head" is a somewhat sluggish black ant, about one-fourth of an inch in length; the head, thorax, and first joint of the body deeply and coarsely punctured like a thimble, and giving a deep metallic green tint in a bright light, while the abdomen is smoother, the segments round to a blunt tip and showing a more coppery tint. The antennæ and legs are of a dull reddish-brown colour, the small eyes brown. The short blunt jaws, when closed, form a rounded tip. The sting short and stout.

The Dark Red and Black Bull-dog Ant (Myrmecia forficata, *Fabr.*).

This is one of the largest and commonest species found about Sydney; it was one of the first bull-dog ants described in Bank's collection from Tasmania in 1787. It has a wide range over Victoria to North Queensland. They live in small communities, digging a cylindrical shaft down to irregular galleries and chambers extending a couple of feet in depth, the material excavated being brought to the surface and forms an elevated ring round the opening. In the early summer they sometimes form a rounded mound above the nest containing a few large chambers in which the pupæ, enclosed in stout brown silken sacks, are brought and kept until the perfect insects emerge. The workers vary considerably in size, measuring up to nearly an inch in length, the whole insect (except the eyes and abdomen which are shining black) is dull reddish-brown, the long jaws projecting in front, armed with fine teeth like a saw; the head finely roughened with parallel lines, and the thorax with transverse ones; the first two nodes (contracted segments) of the abdomen, reddish and shining; the rest heart-shaped, shining, and furnished with a long slender sting, and lightly clothed at the tip with fine hairs.

When they form a nest under a log their nest is much more irregular in form, and the community is much larger than in the regular isolated nest.

The pupæ being all gathered together in a pile immediately under the log, are seized and carried down into the galleries below as soon as the nest is disturbed. The winged female is furnished with long toothed jaws like the workers, sometimes exceeding them in size, and armed with quite a formidable sting. The winged male is more like the smaller form of worker, and can be easily recognised by his small head and short jaws. They hunt both on the ground and among the foliage of low scrub, and are very aggressive beasts, but when among the foliage, though showing fight drop to the ground—a very bad habit when one is pushing his way through the scrub, as they frequently drop on one's head or neck, and sting very severely, they almost seem to know when they come to an exposed place, and bite and sting for the fun of the thing. Sandy scrub lands along the coast and over the Hawkesbury sandstone are the favorite localities for several of our common bull-dog ants, but a few range right into the western country.

The Red Bull-dog (M. Gulosa) figured in the plate is just as common, but is of a lighter red tint, the terminal half of the abdomen being black.

The Black Bull-dog Ant (Myrmecia tarsata, *Smith*).

This is the common black bull-dog ant found in the vicinity of Sydney, and extending up the coast into North Queensland. They construct a somewhat similar subterranean nest with irregular chambers extending out from the main shaft to several feet in depth; in the summer the rounded dome above the nest, formed of the material excavated from below, is full of chambers containing the unhatched pupæ enclosed in stout, elongate, oval, brown cocoons over half an inch in length, and the winged males and females. This species is of a uniform black colour, with the large projecting jaws yellow, and the antennæ, tarsi of the legs, dull reddish-brown. The head and thorax finely lined and roughened; the first aborted joint of the abdomen roughened but the rest smooth, shining, lightly clothed with short hairs and tipped with dull yellow at the apex. When disturbed, if one or two are captured, the other ants retreat into their nest and do not show fight. Their favourite hunting-ground is up and down the trunks of the larger forest trees; but their sting is quite as severe as that of the red bull-dog ant.

The Jumper (Myrmecia nigro-cincta, *Smith*).

There are no pluckier insects for their size than the jumpers, at the first alarm they come jumping out from the side door of their raised mound, which is generally on the ground level, one after the other like a pack of dogs, and fasten on to the first thing they come across; as there is usually a large opening in the top of the nest, the unwary investigator, who has not learnt about the side door, generally discovers it through a rear attack when the jumpers swarm up his legs and begin their investigations. This is a smaller species, slender in form and under three-quarters of an inch in length, black and slightly pubescent on the body, with the jaws yellow and the front and hind portion of the thorax dull brownish-red or yellow, giving it a very

distinct colouration by which it can be easily distinguished from all the other species. This species has a wide range along the coast, and extends inland to a considerable distance.

The Sugar Ant (Camponotus nigriceps, *Smith*).

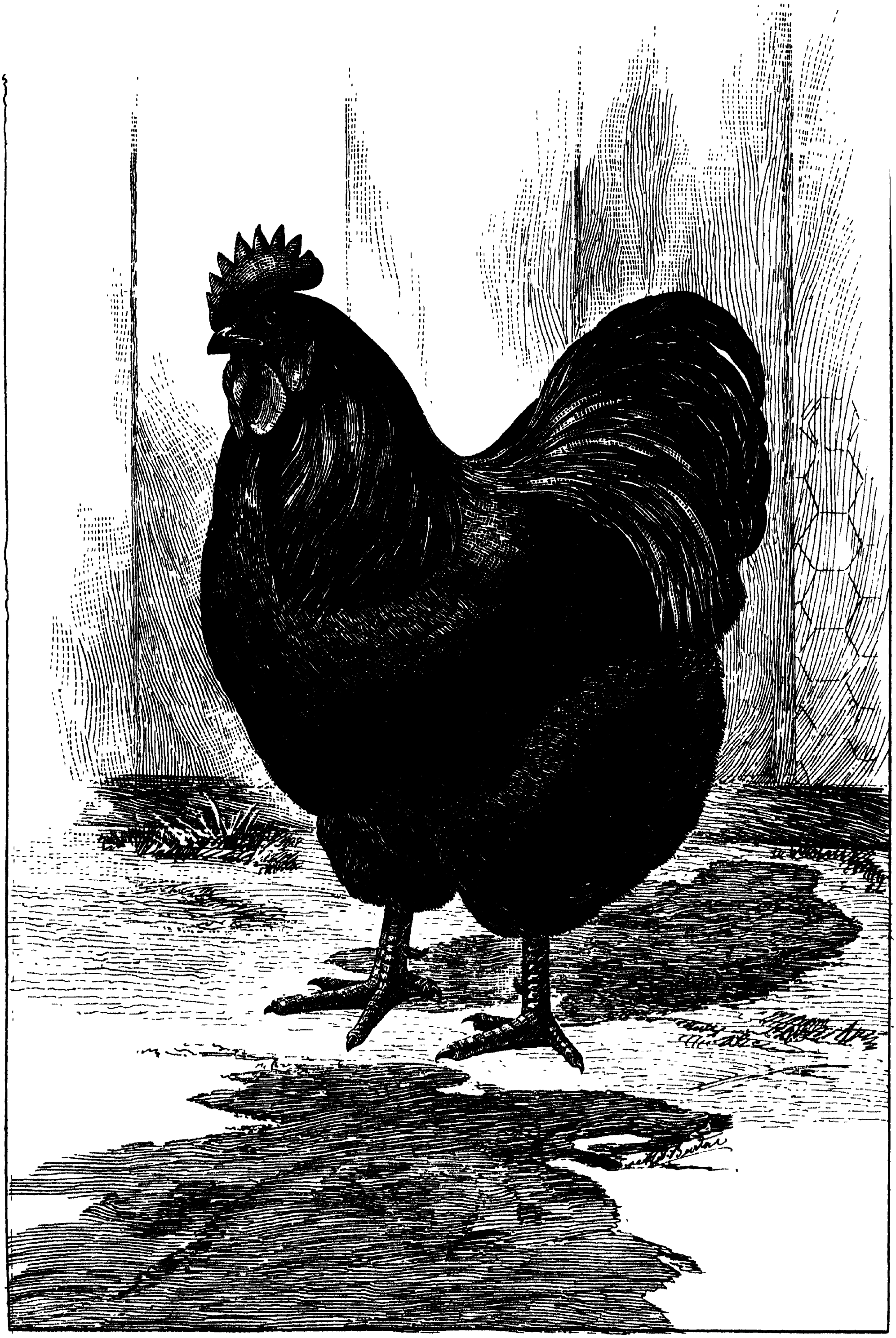
There are a great number of different species of this genus found in Australia, but this is our common sugar ant, which often comes into our gardens and lawns, forming underground nests, and comes into the house at night foraging about for sugar or any kind of sweet stuff that it can find unprotected, and in many parts of the bush make themselves very much at home, and are a regular nuisance, though they cannot sting. I have often watched them on a summer evening round the camp fire, prowling round the edge and even running into the ashes to seize some little moth that had flown into the flame and fallen with singed wings, for though sugar lovers they are omniverous in their tastes and eat anything in the way of food. The structure of their nest is very variable, suited to its surroundings; when under a log or round the butt of a stump it consists of a number of irregular chambers running into each other, with the large naked larvæ piled up in heaps in the centre of the main chamber; but among the sandstone they often build large nests under a stone, when it consists of much larger chambers, containing a great number of both forms of workers, and some winged males and females.

The slender and stout large-headed workers differ considerably from each other in length and bulk, the larger ones measuring up to three-quarters of an inch, and the smaller a quarter less. The large worker has a broad heart-shaped head with the stout short jaws closed in front coming to a blunt tip. The variations of back and yellow are considerable, but the typical forms have the head, antennæ, and apical three-quarters of the abdomen black, the rest dull yellow; in some varieties the upper surface of the thorax is darker brown, but the basal segment of the abdomen is always yellow. This species has a very wide range over Australia and Tasmania.

The Golden Wood Ant (Polyrachis semi-aurata, *Mayr.*).

The wood ants are all fair-sized black insects, with the head short and broad, turned down in front; the thorax is flattened on the upper surface, and the sides forming ridges, with the hind margin often bearing stout spines, and the first joint or node of the abdomen also furnished with a pair, and the connection between it and the short globular abdomen proper very slender. Length about half an inch. This species is of the typical form and colour, with the legs of a dull purplish tint, and the upper surface of head and thorax bronzed with golden pubescence, the abdomen smooth, shining, and clothed on the sides with very fine hairs. These ants live in large communities, forming their nests in dead logs or old tree-stumps, and though chiefly found upon tree trunks often make their way into one's camp in the bush. We have specimens taken from the nests about Sydney, and Mackay, Queensland.

(*To be continued*).



TYPICAL BLACK ORPINGTON

Farmers' Fowls.

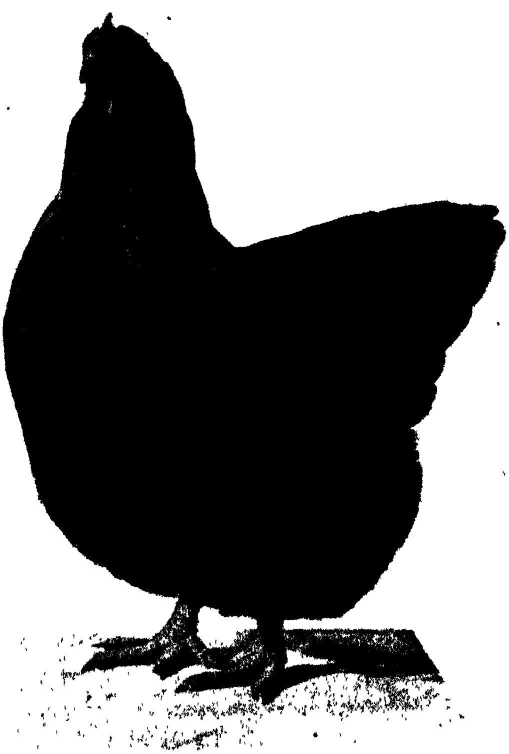
[Continued from page 752.]

G. BRADSHAW.

Chapter XII.

ORPINGTONS.

In 1899 I contributed to the *Gazette* a series of lengthy articles on the above then comparatively new breed of fowls, and having been a close observer of the breed's intrinsic worth from the date of its introduction to Australia, about a dozen years previous, I had then



Mr. L. L. Ramsay's Black Orpington Hen.
Winner at Royal Agricultural, 1905, and other Shows.

but little hesitancy in supplementing the nomenclature with a prefix, the proved worthiness of the breed since that time justifying the adjective so much that at the present day this breed of fowls are most generally written or spoken of as "The Popular Orpingtons." The

title is now well-worn, but none the less justified; indeed, the diversity of the breed's patrons, and its universality amongst those whose conditions are most favourable for profitable poultry keeping, that was there any desire to descriptively enhance the value of the breed, then such might be by way of the affix, "A farmer's fowl."

It should be here mentioned that there is no desire on the part of the writer to unduly inflate the commercial worth of any breed, the sole object being to bring into prominence the salient points of the different varieties of fowls, and to thus enable intending purchasers to discriminate between the claims of such, with a view to obtaining the sorts best suited for their respective conditions or requirements; and when speaking or writing of fowls, I have always studiously avoided emphasising any as the best and only breed; for so sure as such a thing has been done by any writer, the first practical test usually upset the contentions. So far as laying properties are concerned, assertions have been made that a certain breed or breeds are the best. However, did such require refutation, the various laying competitions in the several States have conclusively shown the weakness of such statements; for not only have different breeds made the best performances at almost every test, but at the same test that such breed won, other pens of the same breed frequently occupied the lowest position. Speaking generally, there are a few well-known breeds better layers than some others; but then these better ones when put to a test have been disappointing, and have on various occasions laid actually fewer eggs than did what are called the poor or moderate laying breeds. The whole thing is this: Orpingtons, Wyandottes, and the Mediterranean breed can be relied on as the best layers we have; yet the farmer or other party desiring to commence poultry keeping for profit must not think it is sufficient to secure a setting or two of eggs or a pen of any of these breeds, but rather a good laying family or strain of such; nor is this the result of any lessons from the competitions in the several States, but has been the experience of all practical breeders. Not only that, but hundreds of years ago the then writers on this subject realised that there were good and bad layers among the flocks. In a "Treatise on Husbandry," written by "Maystre Groshede, sometyme Byshop of Lincoln," compiled by the learned bishop for the guidance of Margaret, Countess of Lincoln, who was left a widow A.D. 1240, it appears instructions were to be given to the farm bailiff. From the wording, it is conclusive as to the yield and profit that was expected from well-selected poultry. "Fyve hennes will bring in IIIs. (three shillings) in a yere. I shall prene it by reason, for in halfe a yere be XXVI weeks, that is IX score dayes, and in eche of these dayes shall have an egg of eche henne in that half yere, and XXX eggs be worth a penney. He concludes: "Every henne shall answere you of IX score eggs or of chickens to ye value." Many other early writers frequently refer to good laying hens, one remarking that on a Kent farm in 1790 a hen was known to lay 230 eggs. Coming down to Moubray, the latest edition of whose work was published in 1854, there being then several well-known breeds of fowls, writing of Hamburgs he

says: "They occupy the first rank as layers, the careful trial of a pen of them showing 230 eggs, and another pen 256 eggs each hen for the year." Many instances are recorded by modern writers of extraordinary laying of individual hens, and all emphasising that the feature of laying is governed other ways than by the names the fowls are known by, all unprejudiced writers being conclusive that as egg-producers there is actually no best breed. The same remark applies when a fast-growing carcase is desired. Several breeds have claim to this, while there are people who advocate crosses; whereas the actual facts are that, when tests have been made, the bulk of the claims have been dispelled and the theories exploded, all showing that strain, management, climatic, and other conditions are the factors which contribute to best results.

In the article on the Wyandotte fowls, I have said that, whether for egg or meat, that breed is most profitable to keep, the egg illustrations showing the actual performance and profits, while the photographs of the two dead fowls, reared under my own supervision, proves that the breed, for whatever purpose, is at least one of the best.

The one which I now purpose dealing with is also an excellent fowl, and although a shorter time before the public, is bred by fanciers and utility men alike—by suburban householders, orchardists, poultry and other farmers, and has penetrated to the very uttermost homesteads of the State; indeed, so widespread has the Orpington become in the comparatively brief period it has been before the public, that there is no hesitancy in placing it in the front row of farmers' fowls.

CHAPTER XIII.

Briefly Historical.

As in many other things and matters, the latter half of the present century has witnessed a complete revolution in not only poultry-breeding and management, but also a multiplicity of breeds far in advance of any other kind of stock; indeed, to those not immediately connected with the poultry fancy, the almost yearly announcement of new breeds and new varieties of old breeds prompts the query—What are the circumstances which warrant this annual innovation? the list being now of such inordinate length as to embrace about 100 breeds or varieties of domestic fowls.

The mysterious part of this rapidly-increasing catalogue is the fact that each breed is heralded on its introduction as something in every way superior to its predecessors, and, without questioning the statement that each new production embodies some useful quality lacking in hitherto established breeds, we cannot get over the fact that, did all the new breeds justify, and continue to justify, the characters which accompanied them on their arrival, the latest manufactures in the poultry world would be capable of laying several eggs a day all the year round. Indeed, for the past sixty years there has been a regular procession of new breeds of fowls, each

one, according to those responsible for its introduction, being destined to fill the long-felt want, namely, a bird of fair size, with a rugged constitution, a quick grower of good white flesh, small feeder, and a layer of great quantities of eggs. Whether this want has yet been filled is still a moot question; and even did any of the present day breeds meet the above exactions, there is not a doubt but that in the near future other breeds or varieties would be produced with even greater claims for public recognition and favour.

Whatever difference of opinion exists amongst naturalists and others, the many who have written on poultry, as to their origin, &c., all appear to have agreed that it is impossible to fix the period of their first domestication. It is generally considered as correct that the first notice we have of the domestication of poultry is when we read of King Solomon consuming daily in his household "fatted fowls," while several hundred years after the Prophet Nehemiah had prepared daily for his household an ox, six choice sheep, and "fowls." Many later allusions to fowls are recorded by the ancients. Pythagoras (B.C. 535) refers to them as used for sacrificial purposes. Cicero (B.C. 106), too, informs us that hens were reared and kept entirely for the profit derived from the sale of their eggs; while, according to Pliny, the inhabitants of the Isle of Delos were the first to fatten their fowls by artificial means (cramming, we may suppose), and it was from them, he adds, that the rage for devouring fowls loaded with fat spread like a contagion amongst the luxurious gourmonds of his time, who spent their lives in endeavouring to produce some unheard-of dishes.

These references, however, are only to fowls—what shape, type, colour, or conformation, we know not; but that they were amenable to the fattening process is evidence that, even at that remote period, the poultry were capable of being fattened, which is more than can be said of many at the present day.

At what period domestic poultry became to be differentiated into breeds or classes and named, is involved in obscurity. Certain, however, it is that cock-fighting was one of the sports of Ancient Greece, and several Grecian cities were celebrated for the fighting qualities of their fowls. The sport was also adopted by the Romans about 450 years before the Christian Era, or, as some authors tell us, soon after the Peloponnesian war. One eminent historian tells us that about this time they had a breed of hens at Alexandria, in Egypt, celebrated for their fighting qualities. And even assuming that these fighting-birds of the Greeks were the common or domesticated fowl, the battles were invested with such interest, by reason of the political or religious issues involved, that we may expect the victorious cocks would be specially selected for producing others of like valour, and this process being continued—of breeding from the victors only—would soon produce birds of superior fighting qualities, courage, and endurance; and assuming that such was the case, this family, bred for fighting properties, can, I think, be safely called game, and consequently the first breed of fowls we know of, apart, of course, from the domestic, from which they were bred.

The introduction of game fowls—*i.e.* cock-fighting—into England has been ascribed to Julius Cæsar, but the earliest distinct notice is first found in a description of London by William Fitz-Stephen, a writer of the time of Henry II, who states that the pastime was so generally in vogue that it was the customary game even of school-boys. In the reign of Henry III the sport had become so general that it was found necessary, in 1366, to check it by proclamation. Cock-fighting, however, continued to flourish, royalty itself, in the person of Henry VIII, being one of its patrons, a cock-pit being added to Whitehall by that monarch for his own amusement.

In consequence of the mischievous results attending cock-fighting, Queen Elizabeth, in 1569, was obliged to issue a royal proclamation for its suppression, but with little better results than that attending the ukase of Henry III, 200 years before. It is even recorded that the rigid Scotchman, James I, indulged himself twice a week in the diversion of the cock-pit. And although legally suppressed, the sport has been clandestinely carried on in some of the rural districts (England) to the present day. The sport was introduced to this State in the very early years of its history, the old records stating that in 1798 the Sundays about Parramatta were principally spent by the majority of the inhabitants in cock-fighting; and it is worthy of note that at the present day the district from that to Windsor and Hawkesbury is celebrated for the superiority of the poultry which it sends to the Sydney market, "Hawkesbury Chickens" always realising shillings a pair more than those from any other locality. Our present Colonial game evolved from the old fighting stock of the early days, 80 or 90 per cent. of the fowls bred on the Hawkesbury being of this breed.

The above brief historical facts show that for centuries game (fighting) fowls have been in existence in England, and are consequently the first breed of which we have any record, and whether they evolved from the earlier domestic fowl, or a result from a cross with some of the wild jungle fowl, matters not; they head the long procession of breeds which have since followed, one of the latest being that which gives the title to this paper.

Dorkings are also a breed of great antiquity, one writer at least claiming them as existing prior to the game. At any rate, when Shakespeare makes Justice Shallow, of Glos'ter, order a couple of short-legged hens for his guests' repast, it is considered Dorkings were alluded to. When they were first called Dorkings is involved in obscurity, but can be traced back for over 200 years. However, sweeping all conjectures aside as to the date of origination, the fact remains that at the beginning of the present century we had two acknowledged breeds of fowls, and both at that time noted for qualities which to the present they still possess—the old English Game, a fighting breed, and the English Dorking, noted for its good eating qualities.

A few years afterwards, about 1806, an old agricultural work mentions one or two additional varieties. Following this comes what

is frequently described as the first work on fowls, entitled "Moubray's Treatise on Domestic Poultry," first published in 1814. This now rare work, showing that in the few years prior to that date, although poultry shows were unknown, there were poultry-breeders experimenting with the then few known varieties, to which they applied local names; however, these new creations quickly disappeared, and were heard of no more. The following twenty years were fertile in new breeds, imported or otherwise, those then known being Game, Dorking, Chittagong or Malays, Polands, Bantams, while a black fowl was occasionally seen in several English counties, which is stated to be the ancestor of our present Minorcas. The latter ten years of the first half of this century was the period of all others noted for new breeds and varieties, warranting the author, whom I have already quoted, issuing an enlarged edition with coloured plates of the then best known breeds, namely—Polish, Spanish, Malays, Scotch Bakies, Andalusians, Turkeys, Guinea Fowls, Aylesbury and Muscovy Ducks. Following these came what is known as the Asiatics, *i.e.* Brahmas, Cochins, &c., these varieties shortly after their arrival taking their place as head of the then poultry list for their commercial qualities, the poultry authors of that time, Doyle, Nolan, Tegetmeier, &c., all writing most approvingly of the breeds.

Chapter XIV.

Excellencies and Deterioration of the Old Breeds.

Mr. Tegetmeier, writing about 1852, says: "The Brahmas have the reputation in the States of far surpassing the Cochins as layers, and of being most excellent mothers. The chickens are remarkably hardy, of rapid growth, and feather quickly, and in plumage and colours most closely resemble the parent bird, a circumstance which goes very far to prove that they are a distinct variety to the Cochins, as the fact that the latter cannot be bred true to colour is well known."

Mr. Ferguson, in his cleverly-written work on "Prize Poultry," of about the same date, says: "The flesh of the Brahmapootras is superior in quality to that of the average Shanghais or Malays, is of good flavour, white, plump, and juicy, with less offal, and having the advantage of superior weight over the Dorking; while their eggs are larger than those of the former birds, and more abundant than the latter."

In 1853 there were three pens of these exhibited at the Metropolitan Show, London, and on these the editor of the *London News* remarked: "There is a class of fowls which seem likely to outrival even the Cochin China themselves. They are the Brahmapootra fowls. Not only with regard to the superior quality of flesh, but from the quantity of meat they have on the breast, they are considered to be superior to the Cochin China. The average natural weight per pair is said to be from 22 to 25 lb., the cock ranging from 11 to 15 lb."

Nor can it be said that these useful qualities were connected with the breed only on its introduction, for fifteen years later, in the 5th edition of Mr. Lewis Wright's popular work, it is stated: "With regard to the economic methods of Brahmas, the pullets lay when six months old, and usually lay from 30 to 40 eggs before they seek to hatch, but I have repeatedly known pullets begin to lay in autumn, and never stop—let it be hail, rain, snow, or storm—for a single day till next spring. As to their size, I have had a cock weighing 15 lb. and hens 12 lb., but these are unusual weights. I have, however, two cockerels of this year (1866) only six and a half months old, one of which weighs 10¾ lb. and the other 11¼ lb. I consider 12 to 13 lb. for a cock and 9 to 10 lb. for a hen very good weights. Cockerels for exhibition, when six months old, ought to weigh from 8 to 8½ lb., and pullets from 6 to 7 lb." The above testimony was contributed by a noted breeder of that time, and was confirmed by the author of the work in the following extract:—"With regard to the merits of Brahmas, they rank very high; in size the dark variety surpasses every other breed yet known. They lay every day in the depth of winter, and scarcely ever sit till they have laid 30 or 40 eggs. As winter layers no breed equals them. We are writing at the end of November, and have a hen which has laid 45 eggs in 48 days, while others are little inferior. Brahmas are likewise very hardy, and grow uncommonly fast, being, therefore, very early ready for table, in which particular they are profitable fowls, having plenty of breast meat."

Although grossly exaggerated stories were told of the productiveness of the Cochin when first introduced, and a poultry mania in consequence arose, when this mania subsided, and breeders were able to give a calm and unbiassed opinion of the breed, it was testified to as a most excellent one. Lewis Wright, in one of his earliest editions, says: "The chickens, though they feather slowly, are hardier than any other breed except Brahmas, and will thrive where others would perish; they grow fast, and may be killed when twelve weeks old. They do well in a confined space, and cannot fly over a 2-ft. fence. As sitters and mothers they are unsurpassed. They are prolific layers, especially in winter, when eggs are scarce and dear."

Spanish, another of the old breeds, were world-renowned as good layers. Polish also laid abundantly, while the Hamburg was in its earlier history known as the Dutch every-day layer.

Coming to those of more recent origination, the same tale has to be told; the character which accompanied them on their arrival, or introduction, was a most excellent one, and for some time their credentials were thoroughly justified. Some breeds were noted for one good quality, other breeds were notorious in another direction, while some had the reputed embodiments of everything which go to constitute a perfect fowl. That the majority of the breeds were possessed of the various economic merits there is not a doubt—as the quoted authorities certify, but that these merits are to a certain extent in some breeds partially lost, and in others thoroughly so, is also true; the cause of this retrogression and its bearing on the origination of the Orpington I shall endeavour to show.

Of the multitude of books issued on behalf or in the interests of poultry in England, the favourite apology for their appearance is the huge annual bill of several million pounds paid by that country for foreign eggs and poultry, the object of the works being to lessen this bill in favour of the home producers. Some of the writers have fallen into the error that these immense importations are of recent growth. Such, however, is not the case, as the following extracts will testify:—Mr. Legrand, a member of the Statistical Society, as far back as 1813, tells us that in that year France exported to England one and three quarters millions of eggs; in 1822, they had risen to fifty-five millions, and in 1834 had increased to sixty millions.

A writer in *The Penny Magazine* in 1837 calculated the imports of eggs to England for 1836 from all sources as sixty-nine millions, the British revenue that year benefiting to the extent of over £24,000 by the then 1d. a dozen duty, while Mr. Weld in his statistical survey of Roscommon, stated that £500 was the daily sum paid by England to Ireland for eggs alone. These importations to England kept increasing until about 1845, and for that year France received from England £250,000 for eggs. The foregoing figures and extracts are to show that even at that early date the breeding and rearing of poultry was of much more importance than is generally supposed. It should also be stated that the French importations formed but a small part of the English egg consumption, for independent of her own supplies the Irish shipments to London and Liverpool in 1845 had reached nearly forty-eight millions, the value of which, at the average price of 5s. 6d. per 124, the then price, gives us a sum amounting to about £122,000. The amazing growth of these figures began to cause uneasiness in England, when most opportunely the Brahmas and Cochins came upon the scene, with laying and other qualities so wonderful that the foreign egg trade was considered by some enthusiasts as good as doomed. The introduction of these new breeds was the cause of a complete revolution in poultry-keeping ideas.

Poultry societies were established in most of the large English towns for the encouragement of the best breeds, &c.

Agricultural societies found it incumbent for them to make provision for poultry in their catalogues—indeed, the many merits which characterised these new breeds awoke a general interest in poultry-keeping, which has gone on increasing to the present day; but remarkable to relate, although the Cochin craze, the Brahma boom, and the multiplicity of shows were responsible for thousands of recruits to poultry-breeding, the importation of eggs and poultry to England, in place of being checked by the admitted productiveness of the above, and other new breeds, steadily increased, and why this has been so has often been told by the authors who first noted their many admirable qualities. Some of these same authors are still alive, and now lamenting the decadence of their earlier favourites, have no hesitation in giving reasons why these older varieties have deteriorated, and are obliged to take a back seat in favour of those whose commercial claims are more pronounced.

CHAPTER XV.

POULTRY SHOWS.

SOME fourteen years ago in a prize poultry essay, when contrasting the English poultry-keeping with the French, I described the latter as a country of poultry-breeders and the English as a nation of poultry-fanciers, a slight distinction with a very great difference.

The French peasants breed their fowls for economic qualities, and net their many millions a year profit, several of these millions coming out of the pockets of the English people. The latter, generally speaking, do not trouble themselves about the common commercial side of poultry-breeding, but rather keep them as a hobby, as they do their dogs, pigeons, canaries, and other pets for the interest and amusement they afford, and for the honour and glory attached to winning the prizes, cups, medals, and other honours for which they at their great shows compete.

This competitive spirit has grown to such an extent in the old country that every town of importance has now its poultry show; a late issue of one of the fancier's journals having over 100 of these exhibitions advertised to be held within one month, while during the past year over 700 poultry shows were held throughout the United Kingdom.

The first object of the majority of these fancier's institutions, as stated in their rules, is to encourage and develop the breeding of poultry, and that they do this is evidenced by the enormous support they receive in the way of entries. The valuable money and other prizes offered at these shows provoke a rivalry of the most lively character. It is at these exhibitions breeder meets breeder, when they talk about and study each other's productions, and where the various breeds can be seen, and the specimens examined as to which is superior in colour and shape of its variety, the perfection of this shape and colour being the embodiment of the fancier's art and the fulfilment of the first object of the society. These shows are the great festivals of the fanciers, every breed and variety is brought together, exhibited in spotless condition, compared with each other by the judges, become decorated with well-deserved prize cards and ribbons, &c. Thousands of visitors cheerfully pay an admission fee to witness these great gatherings of feathered stock, whose effect is that not a show passes but many recruits are added to swell the great army of poultry-breeders. Unfortunately, however, for themselves and the poultry industry generally, very many of these annual recruits imagine that the object to "encourage and develop" refers to that for all qualities, economics, &c., or, in other words, that the prize-winning birds being the best birds are the best birds for practical purposes; such, however, is not the case, all other stock, as cattle, sheep, horses, &c., are awarded prizes for the possession of certain points, these points being an index to qualities for which the class of stock is noted; not so with fowls, whose awards are made according to standards that have no relation to commercial qualities. The birds

are judged for appearance only; the knowledge of any cock in the show being sterile would be no handicap to him receiving the championship, while not infrequently the first-prize hen has long prior ceased to produce an egg.

Fancy Points v. Utility.

In a previous issue of the *Gazette*, I pointed out to poultry-breeders for profit that stock for such purposes need not possess show points, but rather the reverse, and quoted authorities to prove this, which, to amateur breeders or those lately entered upon the pursuit, was a surprise. No so with what may be called the genuine fanciers, who breed their birds for pleasure and admit it, although my then remarks on that subject received the general approval of the state, interstate, and foreign press, one writer challenged the statement on the grounds that my authorities were old-fashioned, behind the times, &c. However, the apparent strictures in no way prompts these allusions to the subject, but rather the present article on the Orpington would be far from complete were not an extended reference to the Fancy *v.* Utility subject be made, inasmuch as this, of all others, was the one thing which inspired the late William Cook to attempt making a fowl which should be not only a good one but *continue* to be a good one, independent of, in spite of, or with the assistance of, the fancy or fanciers.

In his work, "Fowls for the Times," the late Mr. W. Cook says:— "When I commenced poultry-keeping many years ago, a few breeders kept good birds. They were, however, bred just for type, and scarcely ever with due regard for utility, until the birds which won in the show-pens were—as indeed they have been, all too sadly, ever since—just the very worst of layers, and sometimes the worst of table-birds;" and further, "One of the things we have yet to learn as a fancy is that it is the fowl, not its feathers, which form the chief value of the bird itself. I therefore set to work, and, by careful and judicious breeding, I was able in a few years to give to the poultry-breeding a breed which, for egg-production and table, has been accepted as the grandest products of the poultry-world."

The authorities I quoted in my previous articles were certainly old, but this was one reason why I selected them—a lifetime in the poultry world and through its many vicissitudes. Mr. Tegetemier was in the heat of the fray when the Brahmas and Cochins arrived, and then wrote of their many excellencies. From that date, now over fifty years, till the present time, this authority has been actively connected with the poultry industry, poultry shows, poultry clubs, and other poultry institutions, and the poultry press, and has been a witness of all the work which tended to bring the above and other breeds from their one time eminence and high estate to be now the most neglected of all by those who keep poultry for profit.

As previously said, very many of the recruits to poultry-keeping brought about by their visits to the show vainly imagine that the legitimate aims of these shows is to improve the breeds in a profitable

sense, the misconception being too often responsible for their short-lived enthusiasm. This misunderstanding occasionally crops up even in the old country, the editor of a leading fanciers' paper there some time ago being obliged to put an end to correspondence by the following:—"We now take up this subject, not so much with a view of adding anything to what has been said by either side, but because this discussion, being a prominent one, may be considered, to a certain extent, as typical. It illustrates the fact that the show-bird and the useful bird are two distinct things. As we have already said, we think there is a confusion of ideas, and the sooner this confusion is cleared away the better it will be both for fanciers and for those who breed poultry with a view to profit. A sort of tradition lingers round the show-pen that the great object of poultry shows is to improve the breeds of poultry from an economic standpoint. This, we think, is a mistake. The legitimate object of poultry shows is simply the encouragement of a most interesting pursuit, which may be followed either for pleasure or profit, according to the taste of those who follow it. Poultry shows, no more than pigeon shows, cage-bird shows, or rabbit shows, have anything to do with poultry from the farmer's point of view. It is true that fanciers themselves encourage the mistake to which we have referred, as it aids them in disposing of their surplus stock to those who do not keep poultry for exhibition, but merely for laying or table purposes. We do not think, however, that this deception is intentional. There is no doubt that poultry shows have done much to spread abroad through the country pure breeds of fowls; and as breed after breed noted for its laying qualities or table qualities in the places from which it has been introduced has come to the front, it has naturally acquired a popular character apart from its exhibition character, and this popular character has clung to it in many instances long after the original economic characteristics of the breed have been lost or impaired by breeding for fancy points. At the last Birmingham show a coloured Dorking hen was sold for £25. Will any one assert that this price was given, or would be given, with a view to its table qualities?"

The above editorial article, as can be supposed, conclusively settled the controversy, but not for all time, as it breaks out occasionally at irregular intervals. The discussion in almost every case being brought about by short-experience breeders, and always silenced by those who have been longer at the game frankly confessing that appearance only was the goal of their ambition.

However, this subject would not receive justice did I leave out two giants in the fancy poultry world, namely, Lewis Wright, and the late Alexander Comyns, LL.B. The former, who, by his great work on poultry, has done more for the fancy than any other author. Wright's poultry book is known wherever poultry shows exist, and is considered by many the standard work of reference on all matters affecting the poultry question. This work was written by a fancier for fanciers, still the author fearlessly embodies the following in his chapter on "Poultry as a National Food":—"For reasons we shall point out in next chapter, it happens that the fancier of poultry, in

whose hands the cultivation of pure varieties has chiefly lain, has, for the most part, sought to develop other qualities than those which are of most importance to the commercial poultry-keeper. He seeks principally for feathers, and as his best birds in point of colour will seldom be also the best layers or fatteners, these points are comparatively neglected. It can hardly be doubted that from these causes some pure breeds, taken as a whole, have actually deteriorated in economic value of late years. That some Houdans and Brahmas, for instance, do not lay so well as these breeds formerly did; and the point to be specially kept in mind is that the commercial producer, by making his selections in the same way as the fancier, but with reference to other points, may attain the same success.

(*To be continued.*)

Hoven in Cattle.

Mr. Peacock, Manager of the Bathurst Experimental Farm, has had the misfortune to have two cows affected during the month of June with hoven, one of which died. In his report Mr. Peacock says:—"The fodders fed to the cows comprised green barley and a small proportion of green lucerne. The loss is difficult to account for. The cows were fed at 7 a.m., and are always under observation till 8·30 a.m., after which they are turned into a grass paddock, which contains no excessive herbage, etc. One cow died about 10 o'clock, the other was saved. The weather conditions were windy and humid, and identical with the conditions upon the previous occasion, when during the forty-eight hours sixteen cows died from hoven in the district. Five died out of ten on one farm; three died belonging to another farmer; three were dead on the road between Kelso and Bathurst; and others were found dead on the road towards Perth. Many of these cows, I understand, had received no lucerne, and the losses are difficult to account for. I consider that the weather conditions aggravated any slight indigestion which might have been caused by the fodder."

This report was submitted to Mr. Stewart, Government Veterinary Surgeon, who makes the following observations:—

"Green succulent fodder, such as young barley and lucerne, are always prone to fermentation, especially when they are wet, either by a fall of rain or heavy dew. Cattle that are not well fed during the night and are put on to this kind of feed with comparatively empty stomachs usually take 'hoven.' A small feed of chaff and bran, or of hay, to prevent cattle eating too greedily, and not turning them into the grass paddocks until the dew is off the vegetation, are good preventive measures. As Mr. Peacock suggests, meteorological influences have an effect on the prevalence of these complaints and maladies."

Weights and Measures.

JAPANESE AND ENGLISH EQUIVALENTS.

[INQUIRIES are frequently made for particulars of Japanese Weights and Measurements, and the following may therefore be useful.]

Pounds reduced to Japanese Kin (Catties).

1 cattie = 1·32277 lb. English avoirdupois weight.
1 qr. = 28 lb. = 21·1677 kin.
1 cwt. = 112 lb. = 84·6708 kin.
1 ton = 2,240 lb. = 1,693·4161 kin.

Pounds.	Catties.	Pounds.	Catties.
1/4	·1890	32	24·1917
1/2	·3780	33	24·9476
3/4	·5670	34	25·7036
1	·7560	35	26·4596
2	1·5120	36	27·2156
3	2·2680	37	27·9716
4	3·0240	38	28·7276
5	3·7799	39	29·4836
6	4·5359	40	30·2396
7	5·2919	41	30·9956
8	6·0479	42	31·7516
9	6·8039	43	32·5075
10	7·5599	44	33·2635
11	8·3159	45	34·0195
12	9·0719	46	34·7755
13	9·8278	47	35·5315
14	10·5838	48	36·2875
15	11·3398	49	37·0435
16	12·0958	50	37·7995
17	12·8518	51	38·5555
18	13·6078	52	39·3114
19	14·3638	53	40·0674
20	15·1198	54	40·8234
21	15·8758	55	41·5794
22	16·6318	56	42·3354
23	17·3878	57	43·0914
24	18·1437	58	43·8474
25	18·8997	59	44·6034
26	19·6557	60	45·3594
27	20·4117	61	46·1153
28	21·1677	62	46·8713
29	21·9237	63	47·6273
30	22·6797	64	48·3833
31	23·4357	65	49·1393

Pounds.	Catties.	Pounds.	Catties.
66	49·8953	500	377·9947
67	50·6513	600	453·5936
68	51·4073	700	529·1925
69	52·1633	800	604·7915
70	52·9193	900	680·3904
71	53·6752	1,000	755·9893
72	54·4312	2,000	1,511·9787
73	55·1872	3,000	2,267·9680
74	55·9432	4,000	3,023·9573
75	56·6992	5,000	3,779·9466
76	57·4552	6,000	4,535·9360
77	58·2112	7,000	5,291·9253
78	58·9672	8,000	6,047·9146
79	59·7232	9,000	6,803·9039
80	60·4791	10,000	7,559·8932
81	61·2351	20,000	15,119·7865
82	61·9911	30,000	22,679·6798
83	62·7471	40,000	30,239·5730
84	63·5031	50,000	37,799·4663
85	64·2591	60,000	45,359·3595
86	65·0151	70,000	52,919·2528
87	65·7711	80,000	60,479·1460
88	66·5271	90,000	68,039·0393
89	67·2830	100,000	75,598·9325
90	68·0390	200,000	151,197·8651
91	68·7950	300,000	226,786·7976
92	69·5510	400,000	302,395·7302
93	70·3070	500,000	377,994·6627
94	71·0630	600,000	453,593·5953
95	71·8190	700,000	529,192·5278
96	72·5750	800,000	604,791·4603
97	93·3310	900,000	680,390·3929
98	74·0870	1,000,000	755,983·3254
99	74·8429	2,000,000	1,511,978·6509
100	75·5989	3,000,000	2,267,967·9763
200	151·1979	4,000,000	3,023,957·3017
300	226·7968	5,000,000	3,779,946·6272
400	302·3957	10,000,000	7,559,893·2513

Capacity.

Japanese.			English.	French.
	Sho.	Square Sun.	English gallons.	French litres.
Shaku	0·01	......	0·003973	0·018039
Go	0·1	......	0·039727	0·180391
Sho	1·	64·827	0·397250	1·803907
To	10·	......	3·972500	18·03907
Koku	100·	6482·7	39·72500	180·3907

The Apple.

[Continued from page 797.]

W. J. ALLEN.

Reinette Jaune Hative.

I HAVE not seen many trees of this variety growing in this State, but in Wagga, in the warmer climate, it is one of the very best early varieties growing there, and can be recommended as such for that and similar districts. It colours up well, and should be largely planted as an early apple in our warmer districts, and is well worth giving a trial in our cooler districts, as it is a healthy strong-growing tree. It should be pruned regularly if best results are to be obtained. It will, I think do better in good rather than in poor soil. One of our best early dessert varieties.

Trees planted in 1894 at Wagga have cropped heavily since 1901.

One of our best early apples. Tree vigorous and spreading, carrying a large crop; fruit medium size, striped with red and yellow; skin smooth and shiny; stalk short, inserted deeply in cavity; calyx closed in a rather broad, shallow basin; flesh whitish-yellow, crisp, sub-acid. Ripens in January.

Stone Pippin.

This variety is found doing well in all the cooler parts of the State, but owing to its susceptibility to Woolly Aphis, many have fought shy of planting it, and a good many of the trees which have been planted have been worked to blight-resistant varieties or dug up and other varieties planted in their place. In our Bathurst orchard, where it is worked on blight proof stock, it has proved one of the best and most constant croppers, and is one of the best keeping varieties there. Last year it kept for five months, at which time it sold readily for 10s. per case. It is grown as a cooking variety, but when kept for months it makes a very fair dessert, being, in my opinion, superior to the Sturmer for this purpose. This tree requires only the ordinary pruning, but will not stand severe cutting back, as will the Five Crown. Trees growing in our experimental orchard have never shown any signs of blight. As a late variety, it is well worth growing in Bathurst and similar districts.

Fruit roundish oblate, slightly conic, medium size, from 2½ to 3 inches in diameter; stalk short, inserted in a shallow cavity which is sometimes russetted; calyx small, closed, set in a shallow but rather wide basin; skin pale green at first, but changed by keeping to pale yellow mixed with green and with a flush in the sunny side; flesh greenish white, acid, perfumed after storing; core small and closed. Bloomed 9th October. Ripens in June. Tree compact, upright, spreading, making stout, vigorous growth. Will bear in its third year. Slightly subject to Water Core. Is liable to thin

itself out before maturity owing to shortness of its stalk. Eight-year old trees are carrying 4 bushels per tree this year at Bathurst. Doing fairly well at Wagga.

Munroe's Favourite.

This is a fine large apple, which does well in many parts of the State, although it does not begin to crop heavily until from six to eight years old. It is a fine cooking apple and makes the best of dried fruit. If kept for a time it acquires a bright yellow colour and is a fair dessert, and has also proved itself a fairly good variety for export. Some growers object to it on the ground that, owing to its large size, it is taken for a cooking apple only, and in consequence does not command a high price. Up to the present, those grown at our Bathurst orchard have always been well sought after and commanded the highest prices. Not very subject to Woolly Aphis, except when making strong succulent growth, at which time the aphis will attack it.

Fruit roundish, conical, even surface, of large size, from 3 to 4 inches in diameter; stalk medium slender inserted in a deep cavity, often russeted; calyx medium, closed, set in a rather wide, slightly furrowed basin; core small, closed; flesh white, coarse, sub-acid, aromatic. Bloomed 9th October. Ripens middle of March. Tree upright, spreading, naturally forming a compact head, vigorous growth. Blooms well, but sometimes fails to set; also falls considerably after setting. Carried a heavy crop in 1903. Carrying 3 bushels per tree this year at Bathurst orchard. Trees eight years old.

Sturmer Pippin.

This is a variety which is largely grown in Tasmania, and one of the best keeping and exporting varieties they have, and will, I think, stand more rough treatment than any other apple grown without showing much damage There are very few places in this State where it has done well—certainly not in any of our experimental orchards; but good specimens of this fruit have been forwarded to the Department from Cooma and similar districts. From what I have seen, however, I could not recommend growers to plant this variety extensively. Short spur pruning appears to suit this tree.

Fruit roundish, somewhat flattened, from 2 to 2¾ inches in diameter; stalk ¾ inches in length, inserted in a round, even, russety cavity; calyx small, closed, set in a shallow irregular furrowed basin; skin yellowish-green, netted with russett; brownish red on sunny side; flesh yellowish, crisp; flavour subacid and rather inferior; core medium, closed; a good keeper and shipper. Bloomed 12th October. Ripened end of April. Tree upright, spreading, vigorous. Fruit falls readily. Carrying 3 bushels per tree this year in our Bathurst orchard.

Five Crown Pippin.

This variety is well known throughout the State, and does well away from the coast and on the higher levels, such as Yass, Batlow, Goulburn, Orange, Glen Innes, &c., but on the coast it has never proved itself a very profitable variety to grow, and growers in such districts would do well to avoid

planting it. It is one of the easiest varieties to prune, as it is naturally a well-shaped tree, and if allowed to grow too large it does not hurt this variety in the least to cut back hard, when it will be found to put on a good growth and make plenty of fruiting spurs. It is not subject to Woolly Aphis, but takes the Mouldy Core badly in some districts. It is one of our best dessert and culinary apples. Does not keep long in some districts.

Five Crown Pippin.

Fruit of medium size, varying from $2\frac{1}{2}$ to 3 inches in diameter; stalk from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch in length, slender, inserted in a deep cavity; calyx closed, inserted in a shallow furrowed basin; skin rich yellow with a flushed cheek on the side next sun; flesh yellowish-white, moderately tender, with a brisk and pleasant flavour, of good quality; only fair for export. Bloomed 30th

October. Ripens middle of March. Tree spreading and moderately vigorous. Fruit crops unevenly; blossoms well but fails to set. Falls readily when developing, also upon maturity, stalks being too short. Carrying 2 bushels per tree this year at Bathurst orchard. Unsuited to the Wagga district.

Granny Smith.

Granny Smith.

A New South Wales seedling, and one of the apples which does well in almost any district, its weak point being that it is very susceptible to Black Spot during wet seasons; but in my opinion, if the trees are properly sprayed

for its prevention, there will be very little trouble with even this disease, as last year many orchardists who had not sprayed lost most of their crops in certain districts, while at our Bathurst orchard not a fruit or leaf showed any signs of this disease, having been sprayed regularly for the prevention of such diseases. This is one of our best keeping varieties, and after being kept several months is good for dessert as well as culinary purposes. Subject to Woolly Aphis.

Tree upright, vigorous. Medium crop; fruit of large size, roundish conical; skin yellowish green, few markings of russet; flesh white, firm, sub-acid, dries well; good keeper; stem long, slender, inserted in a deep abrupt cavity; calyx closed, small, pointed, set in a shallow furrowed basin. Bloomed 10th October. Ripened 8th May. Hangs well. Carrying 4 bushels per tree this year in our Bathurst orchard. Is one of the best late varieties in our Wagga orchard.

Newtown Pippin.

This is a noted American variety which has found considerable favour in the Old Country markets, but up to the present it cannot be said to have shown its superior qualities here, as so far it has not cropped nearly as well as several other varieties. It may, however, improve with age, but I could not recommend intending growers to plant this variety largely. The ordinary pruning, as recommended in previous pages, appears to suit this tree very well.

Fruit roundish, broadened at base, oblique, medium size, averaging from $2\frac{1}{2}$ to 3 inches in diameter; stalk half inch long, inserted in a large deep cavity; calyx small, set in a small and rather shallow basin; skin greenish-yellow, russety around stalk, and with a reddish-brown tinge on the sunny side, and dotted all over with small gray russet dots; flesh yellowish white, firm, rich, juicy, and aromatic—of good quality; good shipper. Bloomed 10th October. Ripens in May. Tree upright, compact, vigorous, rather subject to burning from arsenical sprays. Fruit slightly subject to Bitter Pit. Carrying $1\frac{1}{2}$ bushels per tree this year in our Bathurst orchard.

Late Wine.

Supposed to be of American origin, and is doing well in the Bathurst district. I have not seen it growing in any other district, and therefore cannot say how it would do, either on the coast or in the warmer climates; but it should be worth a trial, as it begins to bear while the tree is quite young, keeps fairly well, and is good for either dessert or culinary purposes.

Fruit roundish, conic, flattened, oblique, of medium size; cavity large, abrupt, at times russet; stem short and slender, and set in a large, deep, corrugated basin; calyx medium, partly open; colour yellow, almost covered with stripes and splashes of red and crimson—a faint bloom; flesh white, tender, juicy, mild, sub-acid, and of medium quality; core small, closed; medium keeper and shipper. A very productive variety. The fruit is borne singly, and is of even size. Is carrying about 3 bushels to the tree at Bathurst this year.

Perfection (*Shepherd's Perfection*).

This is also an Australian seedling, said to have been raised at Somerville, Victoria, and is found doing well in many parts of the State. It does not

Perfection.

commence to bear until the tree is about seven or eight years old in most districts, and is a very upright close-growing tree which requires judicious

pruning to keep the limbs spread at all, necessitating always cutting to outside buds and branches; and at time of planting, the tree should be started as low as possible, as it makes a very upright growth. The apple shown in coloured plate, *Gazette*, September, 1904, was taken from a young tree, and in consequence is a little above normal size, and the basin is larger and eye deeper than an apple grown on a more matured tree. This apple is one of the very best in the State for export. On the lighter soils in this State, and where the fruit is well exposed to the sun, it attains a very much higher colour than the specimen shown in the plate. Only slightly affected by Woolly Aphis.

Fruit roundish, narrowing towards eye, medium size, averaging from $2\frac{1}{2}$ to 3 inches in diameter; stem medium, slender, set in a russety cavity; calyx medium size, partly open, set in a fairly wide uneven basin; colour yellow, splashed with dark shades of red and dotted all over; core small and closed; flavour rich, sub-acid, aromatic, with yellowish firm flesh of good quality. Bloomed 13th October. Ripened early in March. Tree has not borne freely until this year in our Bathurst orchard, where it is carrying $2\frac{1}{2}$ bushels per tree. Is easily injured by caustic sprays. The fruit has a tendency to split, for some unknown cause.

Lamb Abbey Pearmain.

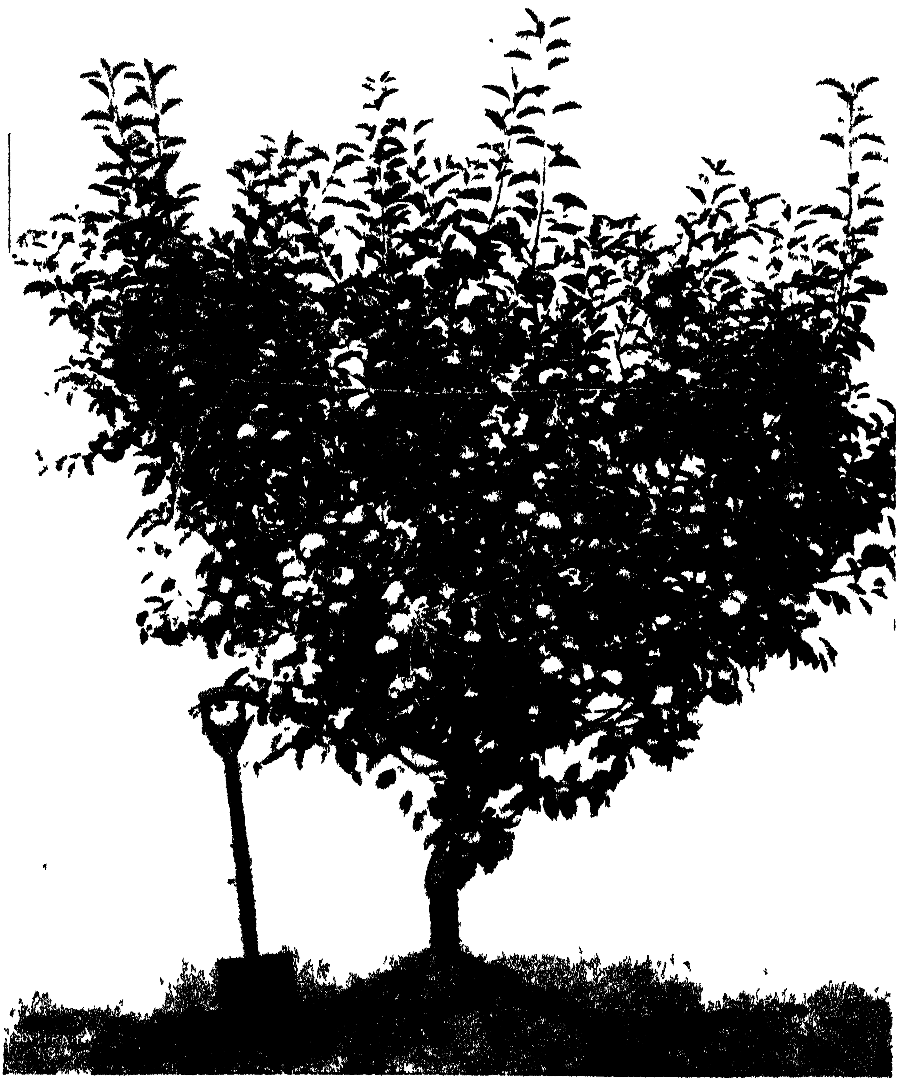
This apple has not been at all extensively planted in this State; consequently I am not in a position to say much about it. According to Hogg, it was raised in the year 1804 by the wife of Neil Malcolm, Esq., of Lamb Abbey, near Dartford, in Kent, from the pip of an imported fruit of the Newtown Pippin, and is said to be a dessert apple of first-rate quality. Is a winter apple, and keeps fairly well. Tree upright and rather stunted, poor crop, medium size, roundish, oblate, angular; skin dull yellow splashed with brownish red; flesh white, crisp, and firm, with good flavour; subject to Codling Moth. Blooms 10th October. Ripens 5th May.

Jonathan.

This variety has given general satisfaction wherever planted throughout this State, whether in coastal districts, from Newcastle south, and over the highlands. Owing to its good colour and flavour it is a great favourite on the market, and is good for all purposes, making a good dried fruit. Up to the present I have not heard of its doing well in the hotter parts of the State, and in consequence could not recommend its being planted there. Like several other good varieties, it attains quite an age before beginning to carry profitable crops. According to Downing, the original tree of this kind was grown on the farm of Mr. Philip Riek, of Kingston, New York. The tree is fairly hardy, moderately vigorous, young shoots rather slender, slightly pendulous, grayish brown.

Fruit, round, ovate, conic, of medium size, running from $2\frac{1}{2}$ to 3 inches in diameter; stem $\frac{3}{4}$ of an inch long, slender, set in a deep even cavity; calyx

closed, set in a deep broad basin; colour rich red, with dark stripes and splashes; flesh white, juicy, rich, sub-acid, of good quality; core small, closed; only a fair keeper and medium shipper if pulled on the green side. Blooms 12th October. Ripens middle of March. An apple which has for-



Jonathan.

several years commanded the highest price. Unless on exceptionally strong soil, it requires heavy pruning both summer and winter. Is carrying 3½ to 4 bushels per tree this year in our Bathurst orchard, where the trees are eight years old.

Rome Beauty.

An excellent American variety, which commences bearing at an early age, and, given proper attention, carries regular crops of good-sized fruit. It is

Rome Beauty.

well to keep the tree fairly open, so that the fruit will take a good colour, if trees are growing in clay soil. In light soils they are usually well coloured. This variety will do well in most parts of the State, more particularly

on the highlands and coast south from Newcastle, at an elevation of from 700 to 3,000 feet above sea-level. Is very subject to the attacks of Woolly Aphis while young; but as the tree attains a fair age, this pest does not appear to trouble it so much.

Fruit roundish, conic, flattened at base, of large size, varying from 3½ to 4 inches in diameter; stem long and slender, inserted in a wide deep cavity; calyx small, closed, set in a narrow furrowed basin; colour yellow, splashed, and striped with different shades of red; flesh yellowish-white, rich, juicy, sub-acid; core small, closed; good keeper and shipper. Bloomed 19th October. Ripens April. Tree upright, spreading, rather difficult to shape, moderately vigorous, does best in deep soil. An abundant, regular, and even bearer of first-class appearance and fine quality, and rarely falls with the wind. Carrying 3 bushels per tree this year in our Bathurst orchard; also doing fairly well at Wagga.

Grazing Pigs on Lucerne.

Lucerne is the natural food for swine. The pregnant sow on lucerne pasture generally needs no grain at all; at most, but a trifle of corn should she be in a thin condition when turned to pasture. Pigs born from sows pasturing lucerne are unusually fine and strong. After they come, the sows need a little more grain than before, and suckle profusely. The little pigs enjoy the sweet, tender herbage, and thrive on it; but they, too, should have a daily allowance of grain. This is not absolutely necessary, as in Colorado, Western Kansas, and Nebraska many hog ranches are found where no grain is produced or fed, winter or summer, but only lucerne pasture in summer: but the pigs are often sold to farmers in the corn belt to be fattened. It is economy to feed corn on lucerne pasture. Lucerne alone is too one-sided a ration; it is too rich in protein, and too poor in starch and fat. It builds the pig long and lean unless the corn is added, but the amount of corn should be very much less than is needed on other pasture. In Kansas, the State Agricultural College has found that "at this station pigs were pastured throughout the summer on lucerne, with a light feeding of corn. After deducting the probable gain from the corn, the gain per acre from the lucerne pasture was 776 lb. of pork. One lot of fattening hogs was fed all the corn they would eat, another lot all the grain and dry lucerne hay they would eat The lot having lucerne hay made a gain of 868 lb. of pork per ton of lucerne hay."—Jos. E. Wing, in *Penn's Bulletin.*

Forestry.

SOME PRACTICAL NOTES ON FORESTRY SUITABLE FOR NEW SOUTH WALES.

[Continued from page 544.]

J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney

VII.

Remedial and Preventive Measures.

(*a*) *Control of Ringbarking* (see page 540).

(*b*) *Fencing.*—Let me insist upon the judicious fencing of banks to protect their edges from stock and other traffic. I look upon this as one of the most important factors in preventing the erosion of the banks of rivers.

(*c*) *Embankments.*—At present, owners of houses and shops, and farmers, are put to an increasing expense in protecting their properties by means of stone, pile, and paling embankments; but in many cases the methods they are adopting are those of Mrs. Partington sweeping back the ocean, for the floods get at the back of their fortifications, and the last stage is worse than the first. In many cases the owners have large areas of additional land, and do not bother about the problems concerned in the erosion of river banks. The probability is that if a man had only 40 acres, and he lost 10 by a washaway, he would become alarmed, while a large landowner might treat the matter with comparative indifference.

What we see in West Maitland—houses perched on crumbling banks, and left more or less stranded—we see on a smaller scale, *e.g.*, at Murrurundi on the Page River, and in many other towns and villages on smaller creeks. If the welfare of West Maitland were alone at stake, then it might be worth while to resume the town, and to sell the site for farms. But what really is at stake is the rich soil along the whole course of the river, and we should do all we can to prevent this marrow of the country from being wasted.

"It is really pitiable to witness the destruction now going on; all our rivers are suffering—in the Castlereagh, Lachlan, Hunter, and Cudgegong; in fact, the silting up of valuable water-holes and the washing away of alluvial flats everywhere is a serious matter. I recommend many settlers to endeavour to save their property by means of fascines properly constructed, but they are mostly satisfied by throwing a few saplings, which are carried down by the first flood, and do more harm than good.

"Attracted by a fine stretch of water in the Cudgegong River, about 10 miles above Rylstone, a friend of mine purchased a property and built a fine house on the bank of the river; the river soon showed signs of silting up, and although in the first instance he could row a

boat on the stretch of water, in a few years' time it was but a sand bed, and he had to obtain galvanised tanks to secure water for his household. No doubt many of these deep ravines and washaways have been caused by cattle tracks; these soon became water courses, and then good-bye to your beautiful meadow flats and water supply." (J. F. Mann in a letter to the Author.)

(*d*) *Chamfering of Banks.*—I would recommend that the soft banks be chamfered in some places. Where soft banks overhang, as we see in many places, they fall over and tear away enormous quantities of soil. One sees the remains of trees in many of these banks, and they do damage in precisely the same way as do the embedded boulders already referred to.

(*e*) *An American Proposal.*—I desire to bring prominently under notice the simple method of dealing with caving river-banks by means of a paling of willows interlaced with wire as described in the following statement and illustration:—

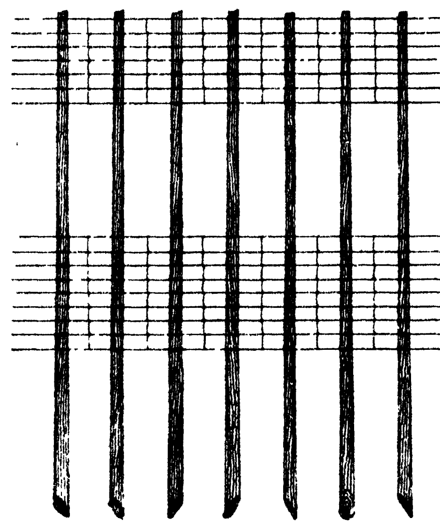
"*Caving River Banks.*—At many places along the stream the flood has left perpendicular banks of soft soil that are being constantly undermined by the current, causing the land to cave into the river from time to time. It is very important that such places be protected, for every such caving bank is a menace to all the land lying back of it in the valley.

"In such a valley, where the bed of the stream does not come within scores of feet of bed rock, the use of stone structures for protecting the river banks is very expensive, and at the same time ineffective. The most successful method of protecting a soft alluvial river bank is to make it sloping instead of perpendicular, and to keep it covered with vegetation.

"The willow is admirably adapted to holding alluvial soil in place. It is far more serviceable for this purpose than walls of masonry, and the facility with which it reproduces itself by seed, suckers, sprouts, and cuttings, both natural and artificial, makes its use very simple and inexpensive.

"The great difficulty with planting any sort of tree on perpendicular banks is that the caving of the soil is so rapid that the planted tree has no opportunity to get a start before it is undermined and precipitated into the river. An excellent scheme has been proposed by Mr. E. Bayles, of Linwood, Kansas. The plan is as follows:—Green willow poles, 18 to 20 feet long, are secured in the spring, just after the ice goes out of the stream. These poles are laid on the ground near the bank 2 feet apart, with their butts all pointing toward the river. Woven fence wire is then stretched along over the poles, and stapled fast to each one. Sections of wire about 100 feet long can be handled to best advantage. After the wire has been securely fastened to the poles, they are all pushed over the bank together, so that the butts of the poles will fall and sink into the soft mud at the water's edge. As the bank caves off some of the falling soil will lodge on the wire, partially burying and weighing down the poles, which will, consequently, strike root and grow. The wire will serve to hold the mass of willows together until they have become firmly rooted. The ends of the woven wire should be made fast to wire cables running

back over the bank some distance, and fastened to posts set firmly in the ground. The caving and erosion of the bank will soon round off its top corners, and the growing willows at the water's edge will catch the soil as it rolls down the declivity, causing a bank to form of just the right slope to resist erosion most effectually. The following diagram illustrates the method of fastening the poles to the wire." (United States Department of Agriculture, Bureau of Forestry, Circular No. 27.)



(*f*) *Planting and Conservation.*—It appears to be very necessary to educate people not to destroy timber and other vegetation on the banks and in the beds of creeks, and in certain places to proceed with replanting. It is quite true that replanting may in many cases mean the utilisation of good land; it is equally true that if remedial measures be not proceeded with there will eventually be no good land left to plant on at all. Planting close to the edge is, I reiterate, a mistake, and arises from a natural desire to make the most of the land—to cultivate as much as possible for crops or grass. But trees and other plants placed too near the edge of a friable bank may be a source of danger, and not a real protection, since they may act as a lever to break down the banks.

1. *Natural Bank Protectors.*—Let us observe the interlacing and ramification of the roots of trees in good soil (such as these flats and river banks). It is very extensive, and their mechanical action in arresting washaways is obvious. One can see evidence that the banks of the Upper Hunter streams were much more lined with trees than at present. In many parts of the Hunter and its tributaries one sees large river oaks (many of them past their prime) leaving no descendants to continue their work of bank preservation. The young seedlings are palatable to stock, and hence they are eaten out if they have free access to them. This points to the necessary precaution that stock should not have unfettered access to the bed of a stream as if it were a public highway. The seedling oaks should be carefully conserved until they are out of reach of stock.

One lays stress on the value of the river oak for purposes of bank protection, for the reason that it has for ages been the natural bank protection of these steams, and has become largely adapted to its environment. At the same time the acquisition of these lands by the white man, and his method of dealing with the banks and adjacent country, constitutes a marked change in the conditions, and it may be that other trees are even better than the river oak for the purposes of

bank conservation. River oaks have not a large tap-root; they have rather flat, spreading roots, which penetrate the rich soil and sit on the bed of gravel already alluded to. When this gravel becomes hard, as it does in so many places, the river oak heels over and falls into the stream just as a boulder does.

2. *Other Bank Protectors* (*exotic*).—Here and there one finds that plants other than river oaks have been utilised to protect the banks. Willows are the favourites, and, I think, rightly so. They grow naturally on the banks of streams, and during the winter months propagate naturally or artificially by cuttings very readily. Thus a flood which breaks off branches is the means of establishing other trees lower down. Stakes of willow up to 6 inches in diameter may be driven into the banks near the water, and in an ordinary season may be relied upon to flourish. At Segenhoe there is about a quarter of a mile of *Nicotiana glauca*, a South American weed, under the steep bank, which is of some value as a protector of the banks. It forms a dense scrub, and prefers drier situations than willows. On the Upper Hunter the common passion vine has been found useful, in connection with willows, as a bank protector. Doubtless other riparian owners pin their faith more or less on other plants.

My view is that on the Upper Hunter the main bank-protectors should be trees; on the Middle Hunter, small trees or scrub; and on the Lower Hunter, where the banks are usually low and friable, I would recommend creeping shrubs and grasses, and other plants with underground rhizomes. I, therefore, make the following suggestions of readily available plants for the districts stated. Although prepared for a specific locality, it will be suggestive in preparing lists for other localities.

3. *Plants recommended for Upper, Middle, and Lower Hunter.*—

A.—List of trees recommended for the banks of the Upper Hunter:—

1. *Casuarina Cunninghamiana*, Miq.—The "River Oak," which has been referred to in the body of this paper. It may form a very large tree.
2. *Angophora intermedia*, DC., and *A. subvelutina*, F.v.M.—These are rough-barked "Apple-trees." They attain a large size on the flats liable to inundation. Natives of Eastern Australia.
3. *Podocarpus elata*, R.Br.—The "She, Brown or Berry Pine," which flourishes best on the banks of some of our rivers.
4. *Melia Azedarach*, Linn.—The "White Cedar." One of our few deciduous trees. It is also a native of Asia. It grows readily from seed, which it produces abundantly. While this grows readily on river banks and among *débris*, it will flourish on the drier mountain sides, where it may be necessary to develop a rapid forest growth.
5. *Tristania conferta*, R.Br.—The "Brush or Bastard Box," which requires a good depth of moist soil for its full development. It is, perhaps, better known under its nursery name of "Lophostemon."

The following are exotic trees:—

6. *Acer negundo*, Linn.—The "Box Elder" of the United States, a deciduous maple, which affords an excellent summer shade.
7. *Ailanthus glandulosa*, Linn.—A native of Asia, which has several merits. Goats and other animals do not enjoy browsing upon it. Not only will it grow on the banks of rivers, and bind them with its suckering roots, but it is one of the few that will flourish in the almost pure sand of the coast and of the Hunter River estuary.
8. *Plantanus orientalis*, Linn.—The "Oriental Plane," native of Europe and Asia. A noble tree which can be propagated by cuttings or seeds.
9. *Populus angulata*, Ait.—The "Water Poplar" of the Eastern United States, so called because of the damp situations in which it flourishes.

10. *Robinia pseud-acacia*, Linn.—A native of the United States, and commonly known as "Acacia." It is remarkably tolerant to heat and cold, lack of moisture and plenty of it, and to poverty of soil. It will bind shifting sand.
11. *Salix babylonica*, Linn.—The common or "Weeping Willow," which is perhaps the best of all trees for consolidating river banks. Its roots form a net-work which bind soil; it will grow by the very brink of a stream, and its pendulous branches that are broken down by the floods and winds take root lower down the stream.*
12. *Taxodium distichum*, Rich.—The "Virginian or Swamp Cypress," which in its native country flourishes in sour, undrained swamps. It is less tolerant in cultivation, but it flourishes on the banks of waters where its roots can have full play.
13. *Ulmus campestris*, Linn.—The common "Elm," which is well worthy of introduction in the Upper Hunter Valley as a soil-binder.

B.—List of small shrubs or scrub recommended for the banks of the Middle Hunter:—

1. *Buddleia madagascariensis*, Lam.—A well-known plant which forms a rapid-growing, tall, shrubby mass. It is readily propagated by cuttings.
2. *Commersonia Fraseri*, J. Gay.—A tall native shrub, which naturally grows on the banks of water-courses.
3. *Cudrania javanensis*, Trécul.—The "Cockspur Thorn," also a native shrub, which forms an impenetrable mass of dense growth, well calculated to bind soil and prevent further destruction. Propagated by cuttings.
4. *Duranta Plumieri*, Jacq.—A tall growing shrub from the West Indies, which forms dense masses. Readily propagated by cuttings.
5. *Hymenanthera dentata*, R.Br.—This is a tall native shrub, which forms large masses in good soil in many places in our coast districts. In the Upper Hunter district it flourishes remarkably well in many parts Moonan Flat, for example.
6. *Ligustrum spp.*—The "Privets," of which there are several species and varieties. They are all more or less soil-binders, and can be readily propagated by cuttings.
7. *Lycium barbarum*, Linn.—A "Box Thorn," which is a well-known hedge plant. It is not particular as to soil or situation.
8. *Olea europea*, Linn.—The common "Olive." It likes good soil, and although it prefers proximity to the sea, there are many places in the Middle Hunter where it will flourish. The wild olive, which yields but a poor fruit, could be planted; but I would like to see truncheons planted of the best pickling and oil-yielding olives obtainable.
9. *Polygala myrtifolia*, Linn.—A shrub of moderate size from the Cape. Not of special merit.
10. *Salix aurea*, Salisb. (a variety of the Huntingdon Willow, *S. alba*, Linn.).—The "Golden Willow." Most willows are valuable for the purpose under reference.
11. *Tamarix gallica*, Linn.—The "Tamarisk." A native of Europe and Asia, which is very tolerant as regards soil and situation. It grows readily from cuttings, and is a well tested soil-binder, even of sand.

C.—List of grasses, creeping shrubs, &c., recommended for the banks of the Lower Hunter:—

1. *Cynodon dactylon*, Pers.—The "Doub," or common "Couch-grass" of Eastern Australia. It is an excellent soil or sand-binder, so well known as not to require extended notice at this place. This, and the five grasses which follow, form a dense turf.
2. *Panicum plicatum*, Lam.—This is a broad-leaved grass from Southern Asia, which forms a coarse turf when eaten down.
3. *Paspalum dilatatum*, Poiret.—During the last few years this American grass has come into great prominence for grazing for dairy cattle. It and several other Paspalums are excellent sand-binders, and should be encouraged on the Lower Hunter.

* For years the Gunnedah (N.S.W.) Common Trustees have cultivated willows and lopped them for the stock every summer. Cattle especially thrive well on this food, eating every part except the big limbs. Besides being useful for stock, and ornamental if planted on steep banks, willows keep the driftwood back at flood-time, and, by catching drift-stuff, gradually fill up and bind the banks. ("Corvus," in *Sydney Bulletin*, November, 1902.)

4. *Paspalum distichum*, Linn.—"Silt Grass" or "Water Bouch." A native grass, and a good soil-binder in moist situations.
5. *Paspalum cochinchinense* somewhat resembles No. 2 in general appearance, and is well worthy of trial.
6. *Stenotaphrum americanum*, Schrank.—The well-known "Buffalo Grass" of New South Wales. This is a native of America. The nearer the sea the more it flourishes, and it will stand droughty conditions which will destroy many grasses.
7. *Andropogon Schimperi*, Hochst.—A tussock grass from Abyssinia, which stools readily, and which promises to be a valuable grass for New South Wales. I believe it will prove to be a valuable soil-binder for the Lower Hunter.
8. *Cortaderia argentea*, Stapf. (*Gynerium argenteum*, Nees.).—The well-known "Pampas Grass" of South America, which grows in large tussocks.
9. *Imperata arundinacea*, Cyr.—The "Blady Grass" of Eastern Australia, which is a most effectual soil-binder, though not like most of the grasses recommended, a useful fodder plant in addition.
10. *Psamma arenaria*, R. et S.—The well-known "Marram Grass" of North Europe and North America. Its value as a sand-binder in Victoria and New South Wales has now been proved beyond question.
11. *Chloris virgata*, the "Rhodes Grass" from South Africa, is certainly a most valuable grass.
12. *Arundinella nepalense*, Trin.—A New South Wales grass worthy of further experiment for the purpose indicated.
13. *Arundo donax*, Linn.—This handsome "Bamboo Reed" is now well acclimatised in New South Wales, and flourishes in moist situations. It is a good soil-binder.
14. *Arundo phragmites*, Linn. (*Phragmites communis*, Trin.).—The "Bamboo Reed" of New South Wales and many other parts of the world. It grows naturally along the margins of lagoons and water-courses, and its growth should be encouraged on the Lower Hunter. I believe it to be the "Small Cane" referred to in the enclosed letter to me by Mr. Charles Ledger, the well-known South American traveller of "Cinchona Ledgeriana" fame:—"The valleys of the Sama and Locumba are somewhat like those of the Hunter. In the first (Sama) is situated 30 miles of sandy plains near Tacna (Peru). During December, January, February, and March (or rainy seasons) its river, increased by the rains in the interior, rushes down its course from west to east with great force, undermining the banks on both sides, carrying away in that manner acres of soil where the banks are not protected by rows of *small cane* growing to a height of 10 to 12 feet. This small cane breaks the force of the rushing waters, and thus the river overflows its banks without carrying away the soil as formerly. In the same way the valley of Locumba is protected, indeed all valleys so situated in Peru.
15. *Bambusa gracilis*, Hort., and *B. nigra*, Lodd.—Two more small bamboos that I can recommend as bank-protectors.
16. *Arundinaria falcata*, Nees.—One of the smaller Himalayan bamboos recommended for soil-binding. Small bamboos of any species should be tried on the Lower Hunter. They spread from the roots and their tough stems are very tenacious of life.
17. *Cyperus alternifolius*, Linn.—An ornamental sedge from Madagascar, which flourishes in damp situations.
18. *Escallonia rubra*, Pers.—A small shrub from Chili, which might be tried as a bank-protector.
19. *Mesembryanthemum æquilaterale*, Haw.—The well-known "Pig's Face" of our coasts. A succulent-leaved plant, which is useful as a sand-binder where there is not much traffic over the plants themselves.
20. *Phormium tenax*, Forst., and *P. Colensoi*, Hook. f.—Two species of the well known New Zealand flax, which possesses considerable merit as bank-protectors.
21. *Plumbago capensis*, Thunb.—A well-known shrub which forms a dense bushy growth.
22. *Rhagodia hastata*, R.Br., and *R. Billardieri*, R.Br.—Two of our salt-bushes that may be recommended as sand-binders in brackish or seaside situations.
23. *Rubia tinctorum*, Linn.—The "Madder" of Europe, which forms a low, smothering growth. It is worthy of a trial as a soil-protector.
24. *Lippia nodiflora*, Linn.—A low-growing plant which forms a mat on nearly pure sand. It belongs to the Verbena family and has been found on the coast at Tuggerah Lakes and further north. The smaller *L. repens* is worthy of trial. It has been recommended for very dry situations, forming a close turf.

4. *Nurseries.*—Each land-owner should have his own nursery of trees, shrubs, &c. The river oaks yield abundance of seed, and they are easy to rear, and the raising of trees and other plants is not beyond the power of any intelligent citizen. No one doubts the capabilities of our people as eradicators of vegetation; it should be brought home to them that it is to their advantage to act judiciously in a contrary direction.

VIII.

Summary of Proposals.

I will now summarise my proposals for the mitigation of floods. They are not sensational, but they are all practical, and if they be given a fair trial I think that it will be found that they are based on sound principles.

1. Intelligent control of ringbarking or felling. This is the beginning of all things, the attempt to get at the little rifts in the ground-surface that have such mighty consequences.
2. Repair of little incipient rivulets by gradual replanting or placement of obstructions (logs, &c.).
3. Planting of willows and other trees, shrubs, grasses, &c.
4. Chamfering of the banks.
5. Fencing of banks.
6. Burning as much as possible of the dead timber and branches to prevent their finding their way into the water-courses and scouring the banks. There is an especial abundance of dead timber after a drought.

Appendix.—Mountain Torrents in Europe.

I add a statement from one of the best modern works on forestry* in regard to flood mitigation in Europe. The mountain torrents are, as a rule, different in character from the Hunter River, and some of the methods in vogue in Europe would be impracticable here on account of the expense. I repeat my advice "to meet the danger at its source." Let us guard against undue erosion by the creeklets and creeks, and the big river will largely take care of itself. I am only referring to floods which have their origin in the Upper Hunter.

"Private agency can usually do nothing or little to prevent floods. The action of the State is indispensable, as the cost of the erection and maintenance of the works necessary to secure this object is quite out of proportion to the value of the property on which they must be erected; and the work of fixing the beds of mountain torrents and hillsides in process of denudation must be carried out over a large area. The most effective measures depend on the management of the collecting areas of dangerous water-courses, *the main principle being to meet the danger at its source* . . . (the italics are mine.—J.H.M.)

"Serious and successful action, however, is being taken in France,

* Schlich's "Manual of Forestry," Vol. IV, page 501.

Switzerland, and the Tyrol to counteract the causes of floods. The chief rules to be followed are:—(*a*) Revetment of torrents and their feeders. By this means earth, gravel, and boulders are retained in the mountains. Works of the following nature should be designed in accordance with the nature of the locality, the characters of the torrents, the area of the collecting ground, and the funds available:—

1. Barricades of trees, with their entire crowns thrown across the torrents.
2. Wattle fences across the bed of torrents.
3. Dams made of fascines or masonry, to cause the deposition of coarse material, to be constructed across the torrents at suitable distances.
4. Paving the bed of the torrent.
5. Wattle-fencing on revetments along the banks of torrents to moderate the cutting action of the water."

(*To be continued.*)

Drying Herbs.

In answer to an enquiry, Mr. A. A. Dunnicliffe gives the following reply:—

"Herbs, such as sage, thyme, etc., may be dried for market or home use. They are cut at the time they are coming into flower, taking all the last growth, say, from within an inch or so from the crown of the plant. The crop must be dried *thoroughly*, and this must be done in the *shade* to preserve the colour and quality; then they should be packed in whatever air-tight packages that may be convenient, or such as may be adapted to the trade intended to be established. The 'butchers'' herbs frequently come from America, tightly packed in 200 and 400 gallon iron tanks. The herbs are saleable in Sydney. A minimum price, wholesale, of sage is 4d., and thyme, 5d. per lb. Sometimes the price advances in accordance with the state of the market. If the business is to be done on a large scale, a proper drying apparatus would be necessary, which would involve the employment of capital—anything between £100 and £1,000. But it would be better to work in a small way at first, to get experience and to demonstrate the ability to produce a marketable article at the necessary prices."

Rotation of Crops: Bathurst District.

R. W. PEACOCK.

THE most economic system of farming is one based upon a system of rotation of those crops found most suitable to the conditions of a district. It is fortunate that there is such a wide range of crops from which to choose; also that there are various avenues through which such crops may be turned to profit. A profitable system of rotation is inseparably connected with mixed farming. Mixed farming may be interpreted to mean a system in which crops may be grown for direct sale, and also for indirect sale, in the forms of live stock and their products. Such a system allows of the soil, the rainfall, and the atmosphere being linked together most effectively and economically.

Amongst the advantages to be gained from a rational plan of crop rotation are the following:—Soil fertility is retained and, under certain conditions, increased. The plant-food of the soil is more economically appropriated. There is not the same necessity for applications of manures. Weeds which thrive amongst certain crops are checked, and often exterminated, by resorting to a change from one crop to another of a different order. Plant diseases and insect pests may be checked, and often prevented, by a systematic change of crops. Cultivation necessary for the successful culture of one crop may materially benefit a different crop to follow. The locality of live stock is continuously being changed, allowing the pastures to sweeten, and the destruction of parasitic disease germs. The farm work is more evenly distributed throughout the year, which brings about continuous employment and a more settled class of agricultural labourers. Risk of failure is minimised by not staking all in one venture. It allows of monetary returns being available at various seasons of the year.

The elements of plant-food of most importance to the farmer, owing to their being readily exhausted, are nitrogen, phosphorus, and potash. Plants differ in the relative quantities of these elements they require. Cereal crops, if grown for many years upon the same field, may suffer from the exhaustion of one or more of these elements, and are benefited mostly by applications of phosphatic and nitrogenous manures. Leguminous or pod-bearing plants contain large quantities of nitrogen, a supply of which they are enabled, by the aid of micro-organisms, to obtain from the atmosphere permeating the soil. Cereal and other crops have not this power. Applications of nitrogenous manures are, therefore, not so necessary for leguminous crops. Potassic and phosphatic manures generally give beneficial results. Root crops contain considerable quantities of potash, and are benefited by manures containing the three ingredients. The soil may have an abundance of one ingredient, and be deficient of others. Fertile soils contain an abundance of

available plant-food. Some crops are surface feeders; others obtain part of their nourishment from considerable depths. Cereal crops are comparatively surface feeders. Wheats and ryes root deeper than barleys. Lucerne is a very deep rooter, and gathers plant-food from considerable depths, bringing it to the surface in the form of crop. Clovers, also, root fairly deeply; and when these deep-rooting plants are fed to stock on the field, a considerable quantity of the plant-food from below enriches the surface and becomes available for the surface-feeding crops. Root crops, such as mangolds and carrots, are deep rooters, whilst potatoes are surface feeders. Root development has a considerable influence upon the mechanical condition of the soil, and, by growing plants with tap roots, a field may be practically sub-soiled; such allows the moisture and air to permeate the soil more freely, bringing about the liberation of plant-food which would be otherwise unavailable.

Climatic and local conditions determine, in a great measure, the crops which can be used to advantage. Other factors, such as price of seed, may render the general growth of some impracticable. The season of growth must be taken into consideration, as well as the duration of a crop. In farm practice sufficient time to allow of the satisfactory preparation of the land, between the various crops, must be allowed. In districts with limited rainfall several months are required.

Rotations which have been found most suitable for the conditions of the Bathurst district, together with the methods adopted and the reasons for such, as the following:—

Rape, first year; wheat, second year; black tares, third year; wheat, fourth year.

The rape should be sown in February, upon well-prepared land. Upon light soils an application of phosphatic manure, containing a proportion of nitrogen, such as Shirley's No. 3, would be beneficial. The crop is fed off by sheep throughout the winter and spring. The residue of crop and excreta from stock are ploughed under in November. The land is left in this condition until the end of March or beginning of April, when it is again ploughed and sown early in April with wheat. During the summer the crop residue, &c., is decaying and becoming available for the ensuing wheat crop. The moisture of the soil is conserved by the ploughing in November, and any storms or showers are readily absorbed by the surface. Rape is a moderately deep rooter, and the thick roots, after decaying, form air channels in the soil, which are beneficial. The manure applied induces a more vigorous growth from which a greater quantity of stock food is obtained, also the increased crop residue and excreta ultimately form a greater amount of plant-food for the wheat crop. The vegetable matter thus given to the soil improves it mechanically, and the surface is not so liable to get out of condition by consolidating after heavy rains. All weeds, including wild oats and stray wheat plants, peculiar to the wheat season, and which gain a foothold in the wheat crop to its detriment, are destroyed by the continuous stocking of the rape with sheep. The land is perfectly cleaned for the growth of a crop for seed purposes. The wheat crop of the second year yields

considerably more than if it were preceded by a similar crop. The land should be ploughed as soon as possible after the wheat is harvested. The Black tares of the third year should be sown in February or early in March. They do not grow so quickly as rape and do not provide such quantities of winter fodder for sheep. In the spring they provide large quantities of good fodder. The plants should be kept from seeding, and the residue ploughed under about November. This crop is enabled, by the agency of bacteria, to fix in its tissues nitrogen obtained from the atmosphere of the soil. The ploughing in of the residue and excreta from sheep enriches the soil in nitrogen which is, during the processes of decomposition, rendered available for the ensuing wheat crop. By such methods fertility is maintained.

The above system of rotation may be modified to meet the exigencies of the farm. Many other crops may be substituted without materially altering the system. In the place of wheat, other cereals, such as barleys, oats, and ryes, may be substituted. Other leguminous plants, such as Scarlet clover, which is an annual, and field peas, may take the place of Black tares. While mustard would, to a certain extent, take the place of rape. A mixture of both can be grown to advantage.

In a modified form of the above system, lucerne could be sown as the leguminous crop. It makes excellent pasturage when sown upon wheat land. It should be used as the last crop of the course, and be down for three or four years, after which the land can come under cereal crops again with advantage.

To rotations with the summer crops the same underlying principles apply. As cereals, maize, sorghums, and millets may be sown. For leguminous crop, cowpeas may be sown with advantage; they are hardy and make excellent sheep food. Potatoes and swedes may be used as root crops. The cultivation necessary for the successful growth of summer crops, when sown in drills, improves the tilth, keeps down weeds, and liberates plant-food, which is valuable for the ordinary cereal crops, such as wheat. Other crops, such as pumpkins, melons, mangolds, onions, Jerusalem artichokes, kale and sheeps-burnet may be fitted in at the discretion of the farmer.

Potatoes and Mangolds, Bathurst Farm, 1904–5.

Several varieties of potatoes were grown for the main crop and in the variety tests. The results from one plot containing many varieties, owing to conditions beyond control, were not comparative and are not tabulated. The following are comparative :—

	Planted. 1904.	Yield per acre. Tons.	cwt.	qr.
Hero	23 December	5	10	0
Victorian Pink Eye	"	5	7	0
Manhattan	"	5	7	0
Early Vermont	"	5	5	2
Red Skin	"	5	0	0
Irish White	"	3	14	1
Bliss's Triumph	"	3	9	1
Early Rose	"	3	7	3

A few sets of Northern Star were planted ; the result was not satisfactory.

For the main crop, which was planted on the 23rd and 24th December—

	Tons.	cwt.	
Hero yielded	6	13	per acre.
Early Rose yielded	6	13	"
Bliss's Triumph yielded	5	11	"

Three varieties of mangolds were grown, the following being their estimated yields per acre:—

	Tons.	cwt.
Sutton's Sugar	41	13
Prize Winner (Yellow)	34	14
Golden Tankard	31	4

The above were grown upon the irrigation area, and received several waterings. The summer proved rather hot for potatoes.

Poisoning Sparrows.

Mr. J. Walsh, Rosedale, Orange, writes:—"I notice in the *Agricultural Gazette* that the Department is anxious about the methods of destroying the sparrow, poisoned grain having been used with poor results. But I saw an experiment tried, and the result was that about a thousand sparrows fell victims; and no doubt many escaped and died that were not found.

Immediately after the wheat was harrowed-in they swarmed down, eagerly devouring the visible grains; so about a quarter of a bushel of wheat was soaked in a moderately strong solution of rabbit phosphorus poison, and thrown broadcast over the newly-sown crop. The sparrows seemed to like it, and ate every grain. Some died on the spot, but most of them flew to the fences, where they died. In fact, near any place of rest one would find dead sparrows. The consequence is, there are few sparrows on this farm; and I feel sure if all interested would adopt the same measure the same results would follow.

Jam on the English Market.

Customs of the Trade.

Mr. C. C. Lance, in response to inquiries, has forwarded some information as to the custom of the trade in England in regard to the packing of jams, &c.

He says, the general custom of the trade is to pack net weights, whether for home consumption or export. At one time jars containing 14 oz. of jam were very usual, the jars being the same size as the full pound, but thicker. This package, however, is gradually disappearing from the trade, and makers have discontinued quoting it in their lists, though some are still packing for special orders. The theory would be that grocers would sell such as "pots," without naming the weight. In no case does the weight appear to be marked on jam packages. For home consumption, earthenware or glass jars are always used for jam, and these contain 1 lb., 2 lb., or upwards, and, speaking generally, they contain the specified quantity, though makers only guarantee correct weight on the average. Until the larger sizes, such as 7 lb., are reached, it is usual not to weigh each pot, but to fill them, and weights will slightly vary according to the description of fruit. Black currant is the heaviest, and will often go slightly over weight, while large stone fruit will tend to be under weight. A few jars of several well-known makers, tried by me, proved, in some cases, to be slightly under weight, and in one case slightly over weight. In no case were they more than 1½ oz. under weight. Small glass fancy vases containing an approximate amount of jam are sold, and these are referred to in J. and T. Morton's price list as containing "about ¼ lb." In the same catalogue fancy glass jars of honey are specified as containing 14 oz.

The tins of jam put up for export are supposed to contain net weights, and all the information I am able to obtain is to the effect that they do so on an average. One large firm informed me that it was their custom to pack net weights, though they would not say that they would absolutely decline to pack nominal weights if required. English preserved fruits are put up in tins and bottles for export. The tins are supposed to contain the net weight, but foreign fruit in tins, such as Californian, are nominal. The usual 2½-lb. tin rarely weighs even that gross, and the net contents seldom weigh more than 2 lb. The word pound is rarely used in connection with these, the designation "2½" being accepted more as a size. Foreign preserved fruits are quoted in Morton's catalogue in 2¼ lb. tins; these are the same as the 2½ size above referred to, and it is probably Morton's desire to maintain net quotations, though I am sure that these tins rarely contain 2¼ lb. E. and T. Pink quote these tins as "2½ tins."

English fruit in bottles, such as is quoted by J. and T. Morton, and E. and T. Pink, without reference to size or weight, contain about 2½ lb. of fruit. but this will depend entirely upon the kind of fruit, and weight is never considered in regard to them.

Hawkesbury Agricultural College and Experimental Farm.

MILK FEVER.

H. W. POTTS.

THERE can be no doubt about the contagious nature of the disease, and the first duty is to isolate the affected cow from the herd on the earliest information of its presence. To be successful in treatment, attention must be directed to the application of remedies promptly. Delay frequently ends in alarming complications and death. In numerous cases of varying degrees in symptoms and conditions, classified as milk fever, Schmidt, of Kolding in

Injecting Sterilised Air with the India-rubber Ball Inflator.

Denmark, in 1897, arrived at the theory that these symptoms arose from the decomposition of colostrum or biestings and its absorption in the form of leucomaines. To check this he injected a solution of iodide of potassium into each quarter. This form of treatment became very popular. The

mortality was materially reduced, and for a time Schmidt's treatment was generally adopted. The percentage of deaths decreased from 40 per cent. to 17 per cent. We followed the method for some time at the College with equally satisfactory results. Other European investigations pursued a course of tests with etherised air, antiseptic gases, and oxygen. With the latter, Knüsel succeeded so well that mortality practically disappeared. Later on Anderson, of Skonderborg, conducted experiments by injecting sterilised atmospheric air, with the most satisfactory results. Schmidt reports the treatment with air of 914 cases in Denmark—884 cases recovered, or 96·7 per cent.; 140 cows seized were restored to health in 6¾ hours. Only twenty-five out of the number required a second injection, while in only three extreme cases was a third injection found necessary.

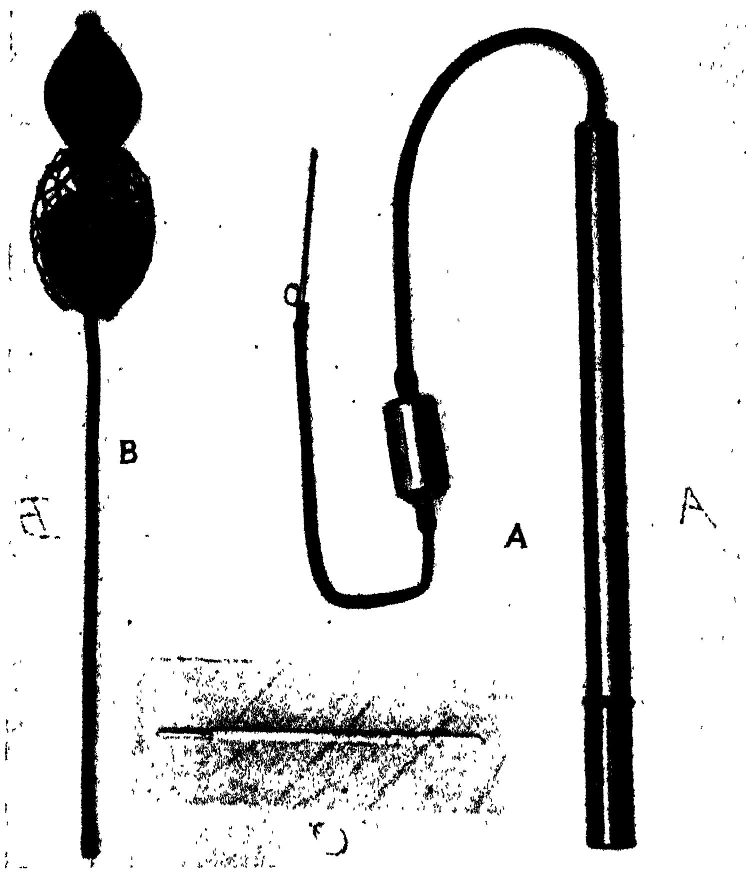
Injecting Sterilised Air with the Bicycle Pump and Foot Attachment.

With this evidence before us, we abandoned the iodide of potassium injections and substituted the sterilised-air methods with excellent result. At first we used the india-rubber ball inflator, as illustrated, in Fig. B. For an odd case it is useful, but where a number of animals had to be injected, and in some cases where there was a difficulty in obtaining sufficient pressure, we found it unsuitable. Moreover, the light rubber soon perishes in our warm climate. We then introduced the ordinary bicycle pump, preferably the one with the foot attachment, so that the pump, while in operation, can be steadied by the operator's foot.

On the first manifestation of the disease the following dose should be promptly given :—

1 lb. Epsom salts.
2 oz. powdered or ground ginger.
1 oz. powdered Gentian root.

To be administered in a quart of thin, warm gruel. Immediately afterwards inject sterilised air into each of the quarters affected.

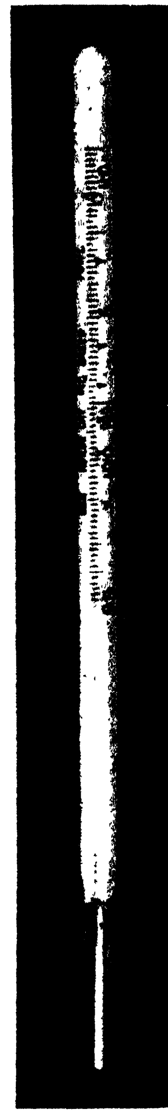


India-rubber Ball Inflator, to attach to cotton-wool chamber and milking tube.

Bicycle Pump, with cotton-wool chamber and milking tube attached.

The apparatus as illustrated (Fig. A) consists of a bicycle pump, to which is attached an india-rubber tube, connected with a small metal chamber. In the latter is placed a pledget of pure cotton-wool, fairly loose, but sufficient to fill the chamber. Over the outlet on the inside of the chamber is a piece of wire-gauze, to prevent the wool being forced into the outlet pipe and choking it. The cotton-wool is that sold at any chemist's, and known as medicated or sterilised wool. Another india-rubber tube connects the chamber with a nickel or silver-plated milking-tube.

When it is possible to milk the quarter without much pain, it is better to do so. The udder and teat should be thoroughly washed with warm water and soap, and afterwards washed with a 5 per cent. solution of carbolic acid, *i.e.*, about three tablespoonfuls to a quart of water after being boiled; or use a 1 per cent. solution of lysol. See that the orifice, or opening into the teat, is well cleansed and disinfected. Use a clean towel to protect the udder, teat, appliances, and the operator's hands from contamination of any kind. The hands and fingers of the operator must be thoroughly cleansed and dressed with the disinfecting solution. Boil the milk-tube in a ½ per cent. solution of washing or baking soda, *i.e.*, about a teaspoonful to a pint of boiling rain-water. Keep the milking-tube free from contact with anything. This precaution is needed to check the invasion of other hostile organisms into the udder, the aim being to insert the tube in a sterile state. In some cases it is difficult to insert the tube; it may then be smeared with carbolised vaseline. When inserted right up to the ring attached to the tube, inject the air at first slowly, then with increased vigour, until the quarter is well distended and seems quite full. Before removing the tube apply gentle pressure all over the quarter, kneading it, or apply slight massage, so as to force the air throughout the milk reservoirs and ducts. In a few instances it has been found necessary to pass a tape firmly around the base of the teat and tie it, but this is rarely required.



Clinical Thermometer.

If the symptoms are not relieved in from six to eight hours, a second injection may be given.

Ducks and Duck Farming.

[Continued from page 701.]

D. S. THOMPSON,
Poultry Expert, Hawkesbury Agricultural College.

III.

THE BUFF ORPINGTON DUCK.

THIS is a breed only very recently developed in England by Mr. W. Cook, of Orpington fame. The late Mr. W. Cook arrived in Sydney by the s.s. Indradevi, on the 2nd of June, 1900, accompanied by a veritable poultry yard—cocks and cockerels, hens and pullets, drakes and ducks, and amongst them the first specimens of Buff Orpington and Blue Orpington ducks to arrive in Australia. At the time of arrival, a poultry scribe thus writes of them: "The ducks comprised two new varieties, the Blue Orpington and the Buff Orpington. The Blue Orpington is a good-sized, square-bodied bird of a blue slate color, and the Buff Orpington a much smaller bird. The Blues may win a place in popular favour, if they are quick in development and as good layers as they are reported to be; but the Buffs are interesting mainly, if not solely, because they are novelties."

Again the question of breed and strain crops up here very strongly. "Never mind the breed," says the expert, "select a good laying strain, and never mind the breed." Well, we have never yet been able to see the force of this reasoning, and we see it just as little in ducks as in fowls. We have no hesitation in answering those people seeking information, as regards the best breeds for laying in ducks as well as in fowls. If you want to know the best breeds in ducks for making money at the present time, go in for Indian Runner ducks and Buff Orpington ducks for egg production.

Poultry farming for eggs will pay better than any other, and will pay better in our own State than in any other State in Australasia. The Buff Orpington duck came to us without any flourish of trumpets further than that the late Mr. W. Cook had a high opinion of them. It has remained for Australia to demonstrate their great utility in the way of producing eggs. The duck is comparatively unknown in any other part of the world, their own home included. They have never so far been taken seriously in England. New South Wales is in the van in demonstrating the great utility points of this new breed, and the N.S.W. Poultry Club is leading the world in giving special classes for them at their annual show.

The duck schedule of nomenclature has been so limited for a number of years, that it has always been a wonder to us that no one ever sought to extend it by the development of new varieties. The list being so limited, there is plenty of room for at least a little extension, and we welcome the Buff Orpington duck as a new breed. There is only one thing, and we would like to mention it just here, and that is, while we have said we welcome the addition of a new breed in duck nomenclature, we would certainly suggest that the name ought to be changed from Buff Orpington to Fawn or Khaki;

buff they are not. You cannot make buff colour out of them, and to give a duck the name of a colour which they do not show is simply absurd in the extreme. Let us retain the name of Orpington, that is all right; the gentleman who placed them on the market, and who developed them, is entitled to every credit, and his designation of Orpington ought to remain; but I am sure if Mr. Cook was still living he would have no objection to changing the colour name from a wrong description to the right one. Now that the Poultry Club of N.S.W. has given classes for them, and led off in that way, they might judiciously follow that up by calling a meeting of the supporters and breeders of this duck, and form a standard to judge by. At that meeting the name of colour could be discussed, and a decision come to, which would then possibly be followed in other parts of the world. That this duck has come to stay there is no doubt, so that the sooner the proper name colour is given to them by some representative body the better for the welfare of the breed. Like all other new breeds, they require some care in mating and breeding, but we can safely say that they breed wonderfully true to colour. To shade they vary; but this is the case with every breed, even whites coming different shades, and blacks different sheens. We have no record of the development of this duck, whether Mr. Cook left a record behind him or not we are unaware, but up to date we have not seen nor heard of any. However, it is easy to conjecture. We have already given our ideas of the origin of the Indian Runner duck, and there is no doubt, as we stated in the last chapter, both the Buff Orpington and the Blue Orpington duck have been developed in the same way, viz., by the amalgamation of the Coloured Rouen with the White Pekin.

Drake. Duck.
Buff Orpington Ducks.

In referring to Mr. Cook's "On ducks, and how to make them pay," on page 87, writing on cross-bred ducks, Mr. Cook says, "If a good number of Pekin and Rouen cross are hatched, many of them will come all brown." We have experienced this in crossing, and by putting the dark brown duck to the Pekin drake a light shade of brown or fawn will be produced. Again, as Mr. Cook explains in the same work, he developed the White Indian Runners by selection: that is, he simply kept on selecting the birds mostly white, until he had them breeding all white. The same could be done in selecting the opposite colour, fawn, and by selecting the birds with most fawn,

Fawn Indian Runners could be produced, but the present Buff Orpington has not been bred by selection from the Indian Runner, otherwise the type would be the same. The present Buff Orpington has some Indian Runner blood, and no doubt it is produced from Pekin, Rouen, and Indian Runner.

As will be seen from his writings, Mr. Cook crossed very extensively with all varieties of ducks, and on producing a new breed which has turned out to be excellent layers, he has shown that the duck family can afford to have the list of varieties extended with benefit to the producing public. Blue ducks and fawn ducks have been developed in many parts of England, but they have invariably been from the Pekin or Aylesbury and Rouen only, and have not been as successful as the Cook production. The simple process of infusing Indian Runner blood into the previous cross has been the secret of Mr. Cook's production of the fawn Orpington duck, which has turned out so successfully as an egg producer.

The Duck Egg-Laying Competition so successfully held at Blackwall, under the auspices of the *Australian Hen* Poultry Journal, and conducted by Mr. Angus Beattie, an experienced veteran, showed conclusively that duck farming for eggs would pay handsomely, and that Indian Runners and Buff Orpingtons would pay the best, the totals of the winning pens of 1,326 eggs for twelve months for J. Ahern's Buff Orpingtons, and 1,315 eggs for A. J. Davenport's Indian Runners, being marvellous records, and the profits made per bird of 8s. 9d. for all Buffs, and 7s. 6d. for all Indian Runners, showing what a splendid sum can be made out of successful egg farming. There is a good demand for duck eggs; the extra size over the ordinary hen eggs gives them a great preference with some buyers. The weight of the eggs of the Buff Orpington ducks we find to be 33 ozs.; those in the Duck Egg-Laying Competition were 31 oz. for J. Ahern, and 32½ oz. for the Burrawong Farm, but these ducks were laying much faster than ours at the time our eggs were weighed. Davenport's Runners were laying 30 oz. to the dozen eggs, so that they compare favourably with each other, not only for numbers, but also for weight of eggs. Mr. Sam. Ellis, of Botany, was the first breeder of them in Australia, we believe, but Mr. J. Ahern, of Arncliffe, must have the credit of placing them favourably before the public.

We are quite satisfied now that they will be a lasting breed in Australia, or in this State at any rate, and while we do not place them in front of the Indian Runner, we admit they are a duck which will rank alongside of this most excellent breed for profitable duck farming.

The Hawkesbury Agricultural College Egg-Laying Competition has given a fillip to egg production in this State, and in other States as well, in relation to hens, and the Duck Egg-Laying Competition will give a fillip to duck farming.

The increase in duck farming, and the extension of the nomenclature of ducks, will be a great acquisition to poultry shows, and it will be a prognostication on our part to say that in a short time the Indian Runner and Buff, or rather Fawn Orpington, ducks will be the largest classes in our principal poultry shows. As there is every sign of this

taking place, our suggestion to the Poultry Club of New South Wales to formulate a standard and discuss the name of the colour, as well as to settle the question of whether a black cap on an Indian Runner drake should be a disqualification, and also the question in regard to the colour of the bill, should be considered, as these matters cannot be settled too soon for the welfare of two such excellent breeds of ducks.

That the breeder believes in the utility of breeds as well as of strains in regard to ducks, it is only necessary to look at the list of competitors for the Second Duck Egg-Laying Competition. Out of sixteen entries no less than thirteen are Buff Orpingtons and Indian Runners, and no doubt the number of Buff Orpingtons would have been much increased only this duck is, so far, only in the hands of very few breeders. Aylesburys, Rouens and Muscovys are all omitted; and even the one great American duck is only backed in two cases out of thousands of breeders in the State. With better weather this year and a selection of better breeds for laying, we can look forward to some phenomenal returns and extraordinary profits from the Second Duck Egg-Laying Competition. Like the Indian Runners, the Buff Orpington has to take a back seat to the Aylesbury, the Pekin, and even the Rouen, for table use, but the breeder, even after running through a successful egg season, would be able to get fair prices for his ducks on the local market. The Buff Orpington we found to be yet a bit hard to rear, no doubt owing to inbreeding, but this would soon be got over, so soon as the duck is bred in different locations. Once matured they are very hardy, and the drakes are very prolific. They grow to about 5 to 6 lb. for ducks, and 6 to 7 lb. for drakes; they can be bred to very much larger size, but there is no doubt that every pound you add to these weights you will suffer from a reduced egg-laying capacity, so that it is just as well to leave the duck at its normal size and not increase it to a great weight. In the absence of a standard for judging, we may be pardoned for having the temerity to formulate one, and although at any conference in the future it may be radically altered, still it will no doubt be accepted in the interim, and perhaps form a basis to work on and lighten the labours of any conference which may be called together to fix and issue an official standard.

Fawn (Buff) Orpington Ducks.

General characteristics in both sexes:—

Head and neck.—Head fine, and medium broad, flat on top. Neck, medium length and fine. Bill, strong at the base, broad, and medium length, not so long as the Aylesbury, and not so broad as the Pekin.

Eye.—Situated like the Runner, high in the head.

Body.—Body long and fairly narrow, wider than the Runner, and carrying a little more weight; but not so wide or massive as the Pekin or Aylesbury. Breast, round and full, and rather prominent. Back, long and fairly wide, showing activity. Wings, fairly powerful, and carried close to the body.

Tail.—Slightly elevated and short, like other English breeds; plain in the duck and curl feathers in the drake.

Legs and feet.—Legs fairly strong and evenly set, giving the duck about the same carriage as the Rouen. Toes, straight and connected by the web.

General shape and carriage.—Fair length, medium breadth, evenly balanced, similar in carriage to a medium weight Rouen.

Size and weight.—Drakes, 6 to 7 lb., ducks 5 to 6 lb.

Colour of Fawn (Buff) Orpington ducks :—

The drake should be an even fawn-colour throughout, with the exception of the head, which should be of a darker shade, indicating the transformation of colour from the Rouen drake, the head of the Buff or Fawn Orpington being of a darker shade of fawn than the rest of the body, exactly taking the place of the green head of the Rouen drake; also the ribbon bar on the wing to be of a slightly darker fawn than the body colour.

The colour of the duck should be an even shade of fawn throughout, medium colour.

Value of points in Fawn (Buff) Orpington ducks.

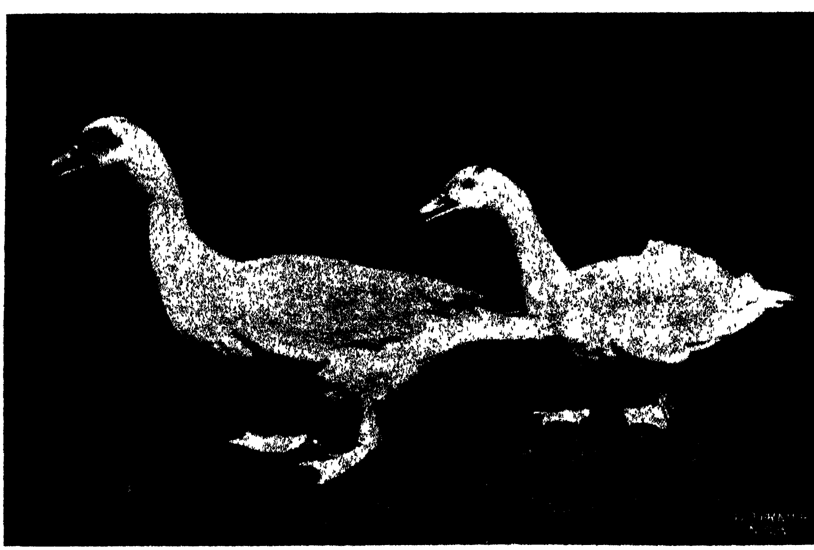
Defects.	Deduct. up to	Defects.	Deduct. up to
Defects in head, eyes, and bill ...	10	Defects in size...	20
,, colour	25	,, type	20
,, condition and plumage ...	25	A perfect bird to count ...	100

Serious defects, for which a bird should be passed :—

Claret breasts; variegated colour; slipped wings; wry tail; twisted bill; ragged plumage.

MUSCOVYS.

THIS is a distinct species. They are not ducks—that has been decidedly proved, as the progeny of these crossed with any variety of ducks are mules, being sterile when mated. Whether they are a species of the goose, or of the swan, we are not prepared to say, as we have never experimented from crossing with either the goose or the swan. From observation and scrutiny of the characteristics of

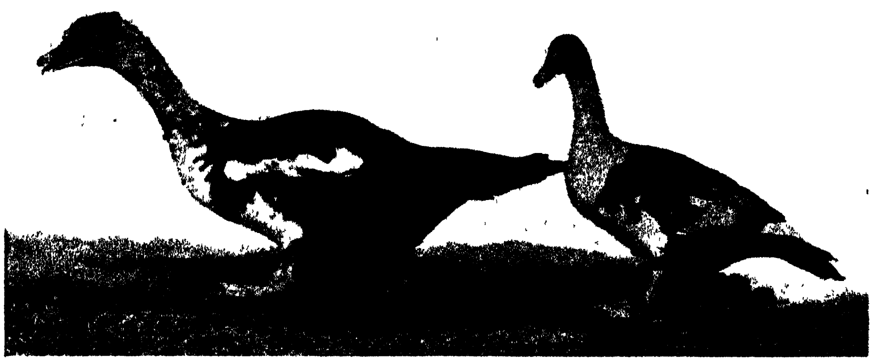


Drake. Duck.

Black Cap Muscovys.

the swan and of the Muscovy, we are inclined to favour the idea that it would be more likely that they would be found a species of swan. They are much like swans in their temperament, in their carriage, and in the hissing sound they make, and also in the number of days for incubating their eggs. However, swan or no swan, they are not a duck, so we simply call them Muscovys. Their generic name is

Cairina moschata, and from moschata the corruption Muscovy has been applied to them. We are classing them and treating them under this paper on "Ducks and Duck Farming" simply from their long association with the poultry yard and their general habits being somewhat similar to ducks, and from their facility in crossing with the ordinary duck. Their original habitat is South America; there they are found wild to-day, where they fly about and build their nests in trees. It has been domesticated for some centuries, and has been well known, although never largely bred, in England for many years. The Muscovy is more popular and more largely bred in this State than in any other part of the world. We have found them to be very prolific, hardy, easily bred and reared, easily fed and fattened, and very useful not only in hatching out and mothering their own



Drake. **Duck.**
Muscovys.

young, but also young ducklings from English ducks. They make very good mothers, and are very cheap, and require little attention as brooders. We have often had them at the College with clutches of twenty or thirty young ducklings, and they have given us no trouble whatever, simply marching around with them all day, keeping them together, and preventing them from straying away, and then taking them to some snug house or box at night, where she would brood over them in turns. During the night they would huddle up under her and get warm, and then make room for some mate, or, rather, as the mate was getting cold, he would exercise his right to push his way underneath the old duck for a little warmth. They are not considered good layers, the Egg-Laying Competition at Blackwall demonstrating that they could not hold their own with the Indian Runner or Buff Orpington, or even the Pekin; but while at the bottom of the list in regard to numbers, they were easily first in regard to size of egg, one pen laying eggs no less than 40 oz. to the dozen, which is almost double the size of some pullets, so that the 500 odd eggs from D. Settree's Muscovys were equal to about 900 eggs from pullets laying an egg about 21 oz. to the dozen.

However, notwithstanding that the late Mr. W. Cook takes his peer in poultry matters (Mr. Lewis Wright) to task for saying Muscovys were bad layers, we could not on any stretch of imagination recommend Muscovys for laying. They are undoubtedly bad layers. Their greatest use is for setting and mothering ducklings, for market ducks, and for crossing with the English duck for table birds, as the progeny are very hardy, grow fast, and attain an extraordinary weight at three or four months, when they make a splendid carcase, carrying plenty of meat, and of excellent flavour. In using them extensively for sitting, the best plan is to have a long box of about twenty compartments or nests which can be shut off at any time, with a duplicate to take its place for the other layers, take away the eggs as they are laid, substituting a few dummies in each nest, and when you have a dozen or so broody, put in your eggs, and about the fifth day test them out. Give about thirteen eggs originally, and when testing out allow about eleven to remain in each nest. Returning your spare Muscovys to the laying yard, it is best to always return the younger ones, as they will leave off brooding sooner than their elders and will start laying again sooner, while, of course, the older birds will sit better. Just before hatching, the best plan is to remove all the eggs to the incubator, except one or two with live ducks in them, so that your Muscovys will be content until you bring back their ducklings. The reason for removing them to the incubator to hatch out is that during the hatching the Muscovy is liable to become somewhat over anxious and in a hurry to remove them from the shell, which she often does before the duckling is ready and it dies, but through the process we recommend, they will hatch out lively and strong in any ordinary incubator. At this time, again, the number of Muscovys can be reduced by double-banking each with a double hatching, which will be eighteen or twenty ducklings.

Mule.

Rouen-Muscovy Cross.

The general colour is magpie (black, and white), and by selection they can be bred all black by following up black selections, or they can be bred all white by the process of selecting birds with white predominating. They are also to be met with in blue dun and in fawn and brown, and there is no doubt in our opinion but that these

colours come from crossing with the Rouen, just the same as the Blue Dun or Blue Orpington, and the Fawn or Brown Orpington, have evolved from crossing with Rouen. We have developed all of these colours. The fawn or brown makes a splendid colour for crossing with the Rouen, while we are now experimenting with White Muscovys and Pekin and Aylesbury ducks; if the cross throws a pure white mule, we conjecture it will be a handsome bird, and a colour which would sell well in the market for the table. The period for incubating Muscovy eggs is thirty-five days, compared with twenty-eight days for the ordinary duck, which again proves they are not ducks.

The Late Mr. W. Cook's Opinion of our Ducks.

In June of 1900, when Mr. Cook was out here on business connected with poultry, he acted as judge at the show of the N.S.W. Poultry Pigeon, Canary and Dog Society, and a few weeks later he acted as judge at the Annual Show as the New South Wales Poultry Club Interviewed by the Reporter of the *Daily Telegraph* on the general quality of our poultry, Mr. Cook said in regard to our ducks: "I think the Aylesbury is fairly well up to the standard, and there are some very nice birds among them. In the Pekins there are some very big birds, the finest I have ever seen for size, but they are not of the Pekin type. The best type birds were on the small side. I am told the big birds are of the American type, but no doubt they have got some of our English Aylesbury type in them, consequently they have got them very long and flat in the body, instead of being broad, and standing erect. I am speaking particularly of show points. I would not detract from the value of these birds to breed from, if they are mated with the right stock. The Muscovy classes of both sexes are the best I have ever seen, both in quality and size. In many parts of England this grand bird is unfortunately almost extinct."

In an interview with the Reporter of the *Sydney Morning Herald*, Mr. Cook said: "Although there is a fine display of ducks, the exhibits do not come up to the English standard. There is a fine field here for breeders of ducks. Among the Pekins there are some very fine ducks, but the largest are not correct in type, being a cross between the Pekin and Aylesbury. However, they make splendid market birds. The Aylesburys are of better type, but they should be bred thinner in the neck, and deeper in the keel. The Indian Runners make a good showing, but there are two colours, the buff and the slate—the former is correct. The Muscovys are a splendid lot, they run right away from the English birds, because there are a hundred bred here where there are five bred at home. I believe there are as many bred around Sydney as there are all over England. I do not quite agree with the judging, one ought to go for colour as well as size, and if a bird is white it should stand before a black one, because it is much more valuable for table purposes. Breeders when they are mating should always keep those that are white, and so work out the black feathering, which detracts from the bird's value as table birds."

It will be noticed from Mr. Cook's remarks, that he soon discovered the amalgamation of Pekin and Aylesbury blood in both our Aylesbury

and Pekin stock, which we speak of in our chapter of these breeds. We would like also to point out that Mr. Cook, in speaking to the Reporter on Indian Runners, speaks of them as buff and slate, so that he makes a mistake in calling the Fawn Indian Runner a Buff, so that will show how he mis-named the Buff Orpington duck in regard to its colour. Although Muscovys have been exhibited for years, there has been no standard for judging by, the judges evidently going by weight only.

In the absence of a standard, and until such times as one is formulated by some official body, with an apology for so doing, we offer the following basis to go by:—

Characteristics of Muscovys:—

Body.—Long, broad and deep. Keel bone, deep, and carrying plenty of meat.
Head and neck—Bright red, broad, crested, with heavy eye cere, and prominent eye.
Legs and feet.—Legs short and strong. Feet webbed, with strong claws.
Plumage.—Bright and glossy.

Colour of Muscovys:—

Colour of both sexes.—No preference as to colour, provided it is distinct. Magpies to be very evenly marked.

Value of points in Muscovys:—

Defects.	Deduct up to	Defects.	Deduct up to
Defects in head and bill	10	Defects in size	40
,, colour	10		-----
,, condition of plumage ..	40	A perfect bird to count..	100

Serious defects, for which a bird should be passed:—

Crooked back, or wry tail.

(To be continued.)

MONTHLY WEATHER REPORT.

HAWKESBURY AGRICULTURAL COLLEGE.

SUMMARY for June, 1905.

Air Pressure (Barometer).			Shade Temperature.				Air Moisture Saturation = 100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 13 years.	Lowest %.	Highest %.	Mean %.	Most in a Day.	Total for Month.	Monthly Mean for 7 years.	% of the year's Evaporation.
29·52 1st.	30·57 27th.	30·12	23·8° 25th.	72·5° 20th.	50·773°	51·2°	54 1, 23	95 29th.	78	0·115 8th.	in. 1·841	1·819	4·0

Rainfall ..									Total for Month.	Mean rainfall for 13 years.
Date ..	1	2	13	21	22	27	28	29		
Points..	17	1	18	2	12	11	2	1	64	2·393

Wind .	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
	1	14	—	—	—	8	1	2

Thunderstorms on dates— ——

Greatest daily range of Temperature, 43·5° on 20th.
Extremes of Rainfall, 5·73 in 1896; 0·15 in 1904.
Days on which Shade Temperature fell below 40.—3, 4, 7, 8, 9, 11, 13, 14, 15, 16, 17, 18, 19, 23, 24, 25, 26, 27.
Frosts on dates.—4, 7, 8, 13, 14, 15, 16, 17, 18, 19, 23, 24, 25, 26.
Remarks.—An average month; dry, with somewhat severe frosts.

CHAS. T. MUSSON,
Observer.

The Saving of Native Grass Seed.—A Neglected Industry.

C. T. MUSSON,
Hawkesbury Agricultural College.

The greater portion of New South Wales west of the Main Range, comprising the Western and parts of the Central Districts, possesses various forms of Native Grasses which may be described as admirably adapted to withstand the rigours of a climate characterised by frequently recurring and often extended periods of shortage in soil moisture. The causes which produce the dry conditions are, a hot sun and drying wind operating where the rainfall is but small to commence with.

These conditions, ameliorated, it is true, by plentiful rain at times, are to be looked upon as characteristic. Drought is the rule, with really good seasons the exception; consequently, in the West dry conditions are to be expected, and should be provided against. The natural plant-covering is provided with such forms as are capable of resisting the exceptional conditions, or are enabled to come on again when favourable circumstances recur, even though the plants, to all appearances, have been killed out. This will occur either through revival of the roots, or even the stems, or through seeds starting the life cycle again.

The special value attached to the grasses of our dry districts is in the fact that they are acclimatised, and in every way fitted for the task they have to fulfil. Very few introduced forms have become useful permanent residents in the West, except Couch in summer and Prairie in winter. For general stock-feeding purposes on a large scale we still have to rely mainly on the native grasses; and probably this will always be the case, although, no doubt, modern methods, together with irrigation, will be responsible for increasing largely the supply of fodder raised under cultivation.

Considering the economic importance of our native grasses, it is remarkable that no systematic attempt, so far as the writer knows, has been yet made to grow them on a large scale, or even to collect the seed for that purpose.

Experimental work has been and is being done to this end. The *Agricultural Gazette* contains numerous papers on grasses, by Mr. F. Turner and Mr. J. H. Maiden chiefly, in which from time to time their cultivation has been urged.

There can be little doubt that, respecting our native grasses and their seed, we are neglecting our opportunities in failing to develop what is a great national asset. Whilst something is being done to try at the Government Experimental Farms various species, the seeds of which are obtained without much difficulty, it would seem that no systematic planting of native grass seed for actual use has been attempted here beyond the experimental work referred to. Nor do we find the seeds of our native grasses catalogued by seedsmen. Indeed, it is doubtful whether 100 lb. weight of such could be purchased in all Australia except under long notice; and even then some of

the seed would be obtained out of the country, as, for example, Wallaby or Silver Grass (*Danthonia*), from New Zealand.

The introduced grass seeds are so easy to obtain, the price is so reasonable, and there are so many to select from, that most people are tempted to try them, rather than think of trying such as are indigenous, and, consequently, acclimatised. The introduced forms are good for such districts as possess a sufficient rainfall. The coastal and mountain areas carry exotic grasses of various species very well. Most of those used, however, if not all, are such as make their growth and come to prime condition in our winter months, although some, as Paspalum, attain maximum growth in summer. Whether any grass is to be a winter or a summer form with us will depend on the nature of the climate in its native country. Where the native home is in the cool temperate zone, it will be a winter grass here ; if in the warm temperate, it will flourish here in the summer.

It may be supposed that the reason why our indigenous grass seeds are not for sale is that *there is no demand for them*. This is probably correct. None are harvested because there are no buyers. It is remarkable that, so far as is known to the writer, no single person has taken up nor made any attempt to push this industry. Constantly are our people trying importations, and, west of the range, with but poor results. This might be expected, for climate will not be denied.

It may be a fact that people do not wish to improve their grass land, being satisfied with existing conditions. Experience seems to have outlined for us the broad fact that our natural grass areas are not improving, but, on the contrary, degenerating. The bare condition to which much of the surface is reduced during lengthened periods of drought gives admirable opportunities for seeding with suitable grasses, even in a small way, without the necessity for all the ordinary processes of cultivation.

One circumstance will always stand in the way of this industry, viz., that the grasses themselves develop with such marvellous luxuriance after periods of useful rain. This will probably induce dwellers in the interior to believe that there is no need to trouble to collect seed, and to act up to their belief by allowing things to take their own course. It is not for all areas that seed is likely to be wanted, although there is no doubt plenty of country would be all the better for a liberal scattering of seed under favourable circumstances as regards season and rainfall.

Supply would create Demand.

It is believed that if useful quantities of the seeds of certain of our native grasses were obtainable in quantity, good condition, true to name, and free from noxious species, there would spring up a demand which would increase from year to year, for everyone must recognise their exceptional value, not only as acclimatised, and consequently being able to resist the exceptional conditions prevailing through our dry interior, but because they are excellent in fattening properties and produce a fair amount of food. There can be no doubt that as the native grasses west of the Main Range have been our stand-by for stock in the past so they will be in the future.

One useful line of work with Native Grass Seed.

It would be admirable work in connection with the preservation and improvement of our native grasses if landholders devoted a few acres to the proper cultivation of suitable kinds for the special purpose of harvesting the seed, and, firstly, sowing down another small seed-plot on different ground whilst scattering any balance of seed over the grass land at suitable times. Suppose, for instance, 5 or 10 acres were sown down to suitable grasses—the seed harvested and another 5 or 10 acres treated next season—the process being continued and considered to be a yearly requirement, in ten years 50 or 100 acres would have been rejuvenated in the matter of the grass covering. The capacity of the soil improved for carrying the growing herbage and the growth thereon would, given average conditions, be itself increased. This would give an opportunity to return to the soil, in a small way certainly, some plant-food in the way of manure to replace what we are taking out by using the grass, and about which we are not concerning ourselves but quietly allowing the soil to become poorer and poorer. This would be a means towards the great end of improving our pastures, especially applicable on areas not suitable or required for farm crops. Such small areas if fenced in would provide small improved paddocks, and could be made of suitable size. For example, a 40-acre paddock could be taken 10 acres at a time and the improved portion hurdled off until the seed crop had been harvested, putting no stock on it until it had seeded a second time, or reserving it for further seed crops. Further, this would be a means towards getting rid of the more undesirable grasses, weeds, and poison plants, whilst securing grazing herbage made up only of known suitable elements. Naturally, the weed problem would crop up, but on small areas detrimental plants can be kept in subjection.

Harvesting.

It must be admitted that collecting the seed is tedious work: for it is important that the seed of each kind be kept separate where possible. This, however, is not absolutely necessary, as will be seen later. Moreover, they are small, thinly scattered over the surface, and there is much mixture of species. There are two methods of collecting: (1) by *hand*; (2) by *machine*; as our grasses are somewhat intermittent in their seeding, consequent upon seasonal peculiarities, it has not been thought worth while to make any attempt at establishing an industry for this work. For these reasons, together with the fact that no strong demand has had to be met, we have practically no native grass seed industry.

Several of our grasses are actually used. Couch, which it is not proposed to deal with here, and Wallaby grass, or *Danthonia*, the seeds of which are obtained, it is believed, from New Zealand. Grass-seed harvesting is followed to a large extent wherever the favourite species are found living in pure communities, *i.e.*, without admixture of other species, as in the Kentucky Blue Grass areas. Our grasses are seldom found in areas occupied by one species; this can only be secured by cultivation. To some extent the species flower at different times. The species best worth cultivation are readily

distinguished. There would be but little trouble in storing and packing. The main work would be the collecting.

One point, however, requires to be emphasised, that inexperienced people are apt to pick the grass spikelets and think they contain seed when in reality they may be empty. Those who gather the seed would soon, by practical experience, be able to determine the condition of the heads.

Disease occurs in the shape of rust on stem and leaves, and smut in the flower-heads. Under no circumstances should seed be harvested where the plants show prominent traces of the former pest, whilst areas found infested with smut should be left alone.

Certain kinds might very well be collected free from admixture, whilst where there is a suitable mixture there is no reason why the seeds should not be harvested without separation into their respective kinds. In the latter case the work would be much quicker, and much more could be gathered in a given time. It would be necessary to see, however, that no detrimental seeds get into the bulk, either of grasses or other plants.

It may be admitted here that it is almost a matter of impossibility to harvest grass seed, especially where it is growing in a natural state, without undesirable seed getting into the bulk. Even when grown as a crop, grass seeds when harvested contain a small percentage of weed seeds. We expect them to be present; but we consider that there should not be more than from 1 to 3 per cent. of impurities present. It need hardly be emphasised that for profitable harvesting of seed there must be at least a fair growth of grass to operate on.

Labour.

It is suggested that in districts where suitable grasses are seeding well, some person might take up this saving of the native grass seed and organise parties of school children or other labour for the purpose, paying at per pound weight or per bushel. It would make very interesting work of a light nature for school children, besides adding to the family earnings. Under proper care, quite marketable quantities could thus be got together.

In New Zealand the children are encouraged, when out after school, to gather during their rambles the "Jew's-ear fungus" and bring home the result, however small. The fungi are dried and stored away. As soon as there is an appreciable weight in pounds, the local storekeeper takes the product over at a price and accumulates it until he has enough to forward to the nearest shipping port where certain merchants operate in the article, eventually forwarding it to China—being used as a favourite article of food. This gradual accumulation of small supplies is also carried out with respect to Kauri gum. Naturally with one very distinct article this method is simple. With numerous kinds of grasses it would be more difficult, but something of the kind might be initiated, and would be simple if each collector took one kind of grass only. Many unemployed could devote time and energy to this work. Once it had started and a demand created for the seed, it ought to bring in good money. Hand labour would probably, in most cases, be adopted, certainly so in the early days of the industry. The man who

enters upon this work would have to organise his party at the best time for collecting. Probably he would have to convey the "hands" to and from the collecting ground and undertake the catering. The seed harvest would not last long, and the whole proceedings would be crowded into two to four weeks, the harvest time being devoted merely to collecting and storing. The cleaning of the seed would best be undertaken afterwards under cover.

Methods of Collecting the Seed.

1. The seeds can be pulled off the grass head by using the hand, the fingers closed over the head tightly enough to bring away any flowers with seed advanced enough to allow it to come away easily. Light pressure and selection of the proper heads showing evident signs of ripening, being the requirements for this method of harvesting. It is a slow process, and would probably only be carried out where seeds of a particular much-scattered species were desired.

2. Dragging the heads off by means of a hand harvester with toothed edges. (See Fig. 1.) The operator passes the instrument quickly with a long scooping sweep over as many grass heads as can be reached. At the end of the scythe-like motions he gives a rapid twist to the instrument which brings it with the hollow part uppermost. The collected seed-heads are placed in a bag and the operation continued. The lighter the scoop, consistent with strength, the easier the process. Children could not use it if heavy. This would appear to be an easy way to operate on most seeds, but would not give a pure sample of any one kind where the grasses were mixed. For collecting seed in a moderate way, and where hand labour is to be employed, this would, however, be the method to employ.

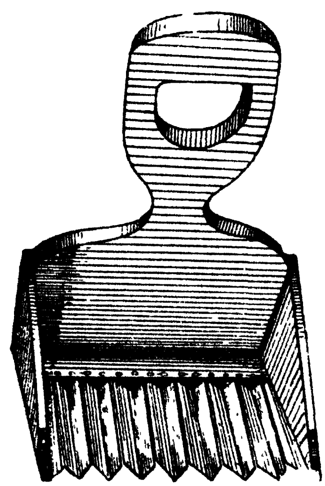


Fig. 1. Hand Grass-seed Stripper.
From Bulletin of Bureau of Plant Industry, U.S.A.

3. A horse-power harvesting machine is used for Kentucky Blue Grass. Such a machine would do very well for our grasses when mixtures are desired or where any species is seeding in considerable areas. It consists of a large deep tray with teeth in front. A spiked drum revolves in the same direction as the wheels, and carries into the body of the machine the heads pulled off by the teeth. The illustration, Fig. 2, show the oldest and most commonly used form of horse-power machine, which consists of a platform hung on wheels and armed in front with a heavy steel comb similar to Fig. 1. When harvesting a labourer kneels on the platform and cuts off the panicles as they are caught by the comb with a flat knife. The product is bagged as found convenient, and conveyed to the drying and threshing place. This can be out of doors or under cover, as circumstances may dictate: probably the former at first, where dry conditions could be relied

upon. Such power machines could easily be made by a local wheelwright, and would be moderate in cost. One horse should be able to draw the machine, which would be of light structure on light wheels. In the use of strippers there is considerable danger of pulling the plants out of the ground, especially where the soil is sandy.

Drying.

The heads should be spread on tarpaulins or other suitable material. Turning assists the drying, which should be completed in two or three days, unless delayed by unfavourable weather. When dry, such seed as shells from the chaff comes away readily.

Fig. 2. Comb Stripper, Common Style.
From Bulletin of Bureau of Plant Industry, U.S.A.

Threshing.

Where the seeds shell freely away from the chaff, the latter should be winnowed away. With a little care, and the help of natural wind, kept sufficiently under control, or made use of when suitable as to its power, there would be little difficulty. Where chaff and small stalks are likely to remain attached, that is where seeds will not shell away easily. Methods of harvesting should be such that when the seeding flowers are stripped there is a minimum of useless material. We have had but little experience as yet in the collecting of our native grass seeds; carrying out the actual processes would soon guide the worker into suitable lines, and provide wrinkles in handling and cleaning that only come with practice. Shaking is the best method of threshing; the use of a light flail would not damage the seed.

Cleaning.

Fanning and sifting are adopted here for seed cleaning on a small scale. In this connection, certain little points in handling the seed are only to be picked up by practice. It will be found very difficult to get rid of all stalks and other useless matter where the coverings (chaff) adhere to the grain, and especially so where permanent awns exist. (The spear of grass seed or Spear-grass, of the Oat and Kangaroo grass, are illustrations of awns.) In some cases the awn falls off readily, as in the Kangaroo grass. Hairs on the chaff will also cause the seeds to mat together. Seeds which shell out of the chaff naturally, as the Love-grasses, are much more easily dealt with ; the lighter thin coverings are not difficult to remove.

A dodge sometimes adopted is that of dry-blowing, *i.e.*, with a wind of the proper strength, to be found by experience. Pour the harvest's product on to a tarpaulin in a slow, steady stream, from a height of 4 to 6 feet ; the wind will blow the lighter chaff particles away. By repeating the process several times the seed is gradually cleansed of its lighter impurities. Small seeds can often be sifted out, as also can larger kinds, together with any stalks and larger refuse. Dust is easily separated in the same way. Seeds that are free from chaff will roll readily on a sloping surface, therefore, in cases where it is found difficult to remove flower-heads or heavy chaff particles by sifting, the bulk may be run along a sloping surface of rough paper or fabric, either fixed or movable to any angle—the latter best, as the angle of slope will be well under control. It will be found that the smoother, heavier seed moves the most readily ; the rougher particles adhere to the rough surface over which they are running, allowing of the seed being separated from the rubbish. Frequent repetition of the process, as required, may be of great assistance in the cleaning up of grass seed.

If the seed is placed in some shallow receptacle, such as a tin dish, tray, or plate, and rapidly rotated in the same way that a sieve is used, or, where possible, with a continuous circular motion rubbish can be concentrated ; hold a plate horizontally in one hand, and rapidly describe a circle on the horizontal plane, the hand moving over a circle about 6 inches in diameter ; by continuing this for a few seconds the lighter material is brought to the top and into the centre of the mass, just as in a whirlpool of water all the rubbish within its influence is carried into the centre.

A few minutes' practice with a dish of seed would teach any man the way to carry out the process, by which much rubbish can be separated that might otherwise be difficult to remove.

Packing and Storing.

The cleaned seed should be packed in bags, canvas or linen preferred. Mice, insects, and vermin of all kinds must be carefully excluded. The seeds must be dry before being packed away. In storing, care should be taken to keep out all vermin, especially insect troubles like weevils and grain moth, which attack stored grain of all kinds.

Strong paper-bags can be obtained very cheaply. For small packets, instead of buying small envelopes, a secure package is easily made by using sheets of paper and folding them into house-made envelopes.

Labelling.

All stored bags should have a label inside, on top of the seed, as well as the usual label tied on the outside. The year of harvest should always be given on the label. It would be convenient also to keep examples of the grasses from which the seeds were obtained, stored away somewhere with the proper references.

It would be convenient also, and fit in with possible requirements, if all stored seed carried a note as to the special habitat. The merchant would necessarily have to be posted up in all matters in relation to the most suitable forms for certain localities, in relation to climate, soil, and habit. Records might include, therefore, with advantage, a statement as to whether the seed came from plain, river-flat, hill, swamp, and the like. It would be just as well to store seed in zinc-lined cases or special bins. Such requirements, however, force themselves on the notice of the merchant, who would readily adapt himself to such details as they present themselves.

Marketing.

Some little difficulty might be anticipated at first in finding a market for the product. Of this the grass speculator would have to take the risk. There are two ways in which he might set to work to secure a market. Firstly, by advertising regularly; secondly, by entering into communication with some well-known seedsman, and leaving the business proceedings to him. It would seem that the man in the country ought to be able to run his own business at first-hand. The method and manner of his advertisements would call for no little ingenuity. The market would need to be made; and if the cultivation of several choice sorts were taken up, even in a small way, the product would be improved; and possibly there might be opened up better prospects of success with a better price for the better product—for the native grasses do seed better under cultivation and the seed is larger; at least, it is so in several species that have come under the writer's observation.

The sending out of small sample packets would also help in making the seeds known. There would, probably, be some demand, once the possibility of obtaining such seed were known at home and abroad, for small packets of the different kinds for grass, garden, and experimental purposes. In such case 1 oz. packets could be made up, accurately named, for the purpose.

The proper naming of all seed sent out would be an important matter. For this purpose, until fully acquainted himself with the different forms, the operator could obtain the required information on sending samples of the plant to the Director of Agriculture. It would be absolutely necessary that the Botanical name be given as well as the local or common name. Date of harvest should always be given, as a guarantee that it is fresh seed.

Price.

As a guide to the value of native grass seed, it may be stated that in June, 1905, Wallaby grass seed (*Danthonia*) was bought in Sydney at 2s. per lb. It is fair to suppose that any good seed of our grasses would be worth the same price. This includes original cost, *i.e.*, the amount paid to the man who harvested the seed and all the numerous expenses incidental to getting the product into the seedsman's store together with his profit. At 2s. per lb. it should pay to enter into the gathering and marketing of such seed, even though it costs 1s. to get it stored away in a saleable condition. Probably this could be done for 6d. per lb. Where seed is plentiful and there is any considerable area capable of yielding a favourable quantity the price would, doubtless, come down in some cases to 1s. per lb., but this could not occur unless machines for harvesting could be freely used.

Weight.

Most of the native grass seeds are very light; the Mitchell grasses, however, and a few others which produce larger seeds, are naturally much heavier. It is interesting to note that the writers previously mentioned, and also the Experimental Farm managers, all say that cultivation improves both vegetative growth and seeding properties. In the list given below, which may be considered as approximately correct, it will be noticed that the difference between seed of the wild Weeping Love grass and that from plants cultivated in the College Grass Garden is, as to weight, largely in favour of the latter.

Approximate Number of Seeds to 1 lb.

		In 1 lb.
Summer Grass	Panicum anguinale	560,000
Parramatta Grass	Sporobolus Indicus	1,900,000
Couch ,,	Cynodon dactylon	1,560,000
Creeping Millet	Paspalum brevifolium	170,0,000
Small-flowered Panic	Panicum parviflorum	1,570,000
Star or Windmill Grass	Chloris truncata ...	1,900,000
Slender Love ,,	Eragrostis leptostachya	400,000
Weeping Love Grass	,, pilosa (wild form)	850,000
,, ,,	,, ,, (cultivated form)	330,000

How to Tell when Seeds are ready.

The time to collect is when the seeds are ripe. This can only be properly judged by experience. In a table below will be found the approximate times when some of the species worthy of attention in this matter are ready It will be seen that summer ripening is the rule, December being perhaps the best month. Unseasonable climatic conditions may retard the ripening process, whilst exceptionally mild conditious, with useful rains during March, April, and May, will cause the grasses to ripen seed freely during the latter month. During May and June, 1905, the writer collected abundance of good seed from the College paddocks of six of the species given in the table, which are usually summer seeders. By regularly observing the grass heads, it is tolerably easy to tell when the seeds are ready. Commonly the seeds

are not all shed at once; but fall away a few at a time. In cases like the Love grasses, where the flowers are numerous in each spikelet, the central flowers ripen their seeds first. Where the spikelets carry only one fertile flower the ripening commences at the distant end. The appearance of the spikelet, with a rough trial, will give all necessary information to the practised eye.

It will frequently be the case that on taking the whole flower-head some seeds will be green, others fully ripe; it is necessary to select a time for harvesting, when the great bulk of the contained seeds are sufficiently advanced for the purpose. Many species are found growing inland as well as in the coastal districts. Such may be expected to be a month later in the coast as compared with the interior, in the ripening of their seed. The different districts of the State if exploited for grass seeds would need to be considered, in respect of the "proper time to collect," on their own merits. North would be a little ahead of the South. The higher any locality lies above sea-level the later it would probably be as to ripening time for the grass seeds. Careful observation would tell the collector as to the right time. Seasonal variations would also affect the harvest in retarding or hastening it, as already mentioned.

The Grasses worth Harvesting.

With respect to the question as to what species are worth saving, it may be stated in broad terms *all are good*, but that it would not be found possible or even advisable to attempt saving seed from more than a dozen kinds in any one district; and this for several reasons, the chief being that a few forms would predominate over all the others in quantity; whilst many would only be found scattered here and there; the latter could not be taken in hand except in the case of special requirement calling for small experimental packets; in such cases hand-picking would be the only possible means for harvesting. It must be understood that certain groups of grasses should be severly left alone, the Spear grasses and those with burr-like flower-heads. Of the forms it might be found advisable to take in hand, some would be much more easily harvested than others, and in much greater quantity. Naturally the collector would take advantage of every point that made his work easier. Probably the first and best thing to do would be to make himself acquainted with the grasses of his district, and seek expert advice as to the species really worth saving.

Some grasses, it may be noted, are easiest propagated by division of the roots; the grass-seed merchant might very well try and increase his sales by taking up this line along with seed-saving

The chief requirements would be in the direction of securing species that are perennial, carry a fair bulk of leafage, with stems on the succulent side rather than being cane-like and hard; such as are turf-formers, that is, spread by underground or above-ground stems, or root freely at the joints. Annuals are not so much required.

Below will be found a short list of species suggested as likely to be useful, and for which there might grow up a demand if good fresh seed were always available. It is likely, without having at the present time any knowledge as to the effect of age on our native grass seeds, that they would keep good

for at least two seasons, perhaps three. This list might be extended, but is considered sufficient for the present purpose. The collector would have to

Native Grasses.

1. *Eragrostis.* 3. *Danthonia.* 5. *Astrebla.*
2. *Erichola.* 4. *Panicum.* 6. *Chloris.*
7. *Andropogon.*

take the grasses of his district, and whilst some forms would be found very widely spread, certain others would only be local in their distribution; he would have to adapt himself to circumstances.

Time when Seed would be required.

Grass seed is better sown in the autumn than in the early spring, therefore seed for market should be ready by March. This would give ample time to prepare it, supposing the harvest was completed in January.

As already stated, and shown in the accompanying list, these plants ripen their seeds ordinarily in the early summer, though much variation occurs in the date.

Probable Requirements for Planting.

To plant an acre with grass it is customary to put in from 20 to 40 lb. weight of seed. It is said that an acre will carry, when well clothed, 15 to 20 millions of plants, possibly double that quantity. Taking 20 millions as an average, this allows for about 460 plants to the square foot; all these would not be grasses. Any acre planted with a mixture of the nine grasses mentioned, in relation to number of seeds in a pound weight, would require on the above computation 17 lb. of seed; but it is customary to allow a considerable margin for loss in the shape of seeds eaten by birds, destroyed by insects, or not possessing germinating capability; therefore, it would not be out of the way to plant 30 or 40 lb. for each acre.

Judging by cases that have come under our observation here, and from other information, there can be little doubt but that the "stand" of native grasses in any paddock would be immensely benefited by cultivation; in the deepening and loosening of the surface soil, and light manuring. It would be interesting to know the effect of irrigation on our mixed grasses; judging from good growth in isolated favourable spots, from the increased growth and size of the leaves, together with the consequent extra succulence, irrigation might be worth trying.

The Rights of Property.

The question of land ownership naturally crops up; the "right to enter" for the purpose of collecting grass seed does not pertain to all and sundry. This is a matter that would require arrangement as between occupier and the seed collector. In most cases it would only be a matter of "terms." Any royalty charged could be but small, as the product would be very light, and the amount of damage done, in the way of seed removed, would be almost infinitesimal. The main difficulty would be in finding areas suitable for seed collecting undamaged by stock.

Points worth special attention.

Get to know the grasses of your district, and find out which are especially worth saving.

It is very easy to harvest what looks like seed, when in reality the seed has not yet ripened or perhaps even formed.

In some plants there is much chaff and but little seed; the Kangaroo grass, for example, where only one seed is formed for every bunch of seven flowers. Therefore, collectors should be able to instruct the workers as to where the seed is.

Where heads have an awn or beard, a more or less hard and tough appendage or prolongation attached to some flowers—fixed in the Spear grasses and falling away in Kangaroo grass—this awn indicates the position of a fertile flower where a seed is likely to be produced.

There are numbers of barren flowers in many of the grasses; every other one in the Blue grasses, and six out of seven in the Kangaroo grass. Many of these could be got rid of in the process of cleaning, where the seed is free from chaff, and is consequently separable therefrom more readily than in cases where the chaff adheres to it permanently.

When labelling, keep a note of the district in which the seed was harvested, as buyers would require seed for cool, hot, or some special locality; and it is better for the seed to have come from a climate as nearly like it as possible. Special habitat should be noted—as swamp, plain, or hill grasses.

Examples of the growing plant, showing flower-head, should be shown up by all pickers with each package of seed, as a means for identification.

Do not harvest from smutted or prominently rusty plants.

Harvest no real Spear-grass seeds.

Harvest no Burr-grass seeds.

Grow small plots from seed harvested and save the seed therefrom. This will prove the quality and kind of that collected, and will also give an opportunity to secure a cultivated strain which is commonly larger than that obtained from plants growing under natural conditions.

The saving of seed could be carried on along with this cultivation for seed purposes; and there is a possible trade in roots, where the latter are useful for propagation purposes.

Most of the Grasses have been illustrated in the *Agricultural Gazette*, which can be seen in all Public Libraries.

Other publications on the subject are:—

"Census of the Grasses of New South Wales," F. Turner, 1890.

"Australian Grasses," F. Turner, 1895 (illustrated).

"Manual of the Grasses of New South Wales," J. H. Maiden (illustrated).

Conclusion.

In conclusion, the writer wishes it to be understood that this paper is written in a *suggestive* spirit rather than from the dictatorial or advisory standpoints.

It is hoped that herein may be found some hints likely to be of use to those who are on the lookout for a new outlet for their energies. It cannot but strike the thinking man that here is a line which, some day will be taken up with energy; and in the starting of anything rather away from the beaten track, it is usually the first people in who seize the trade with its resultant profits. Once started, energy and proper methods in its management should enable the operators to build up a lucrative business in which they would have the field, for a time at least, all to themselves.

The writer is indebted to numerous authorities in the preparation of this paper, and hereby makes acknowledgment.

GRASSES the Seeds of which are worth saving.

			Seeds Ripen— Oct.	Nov.	Dec.	Jan.	—	Illustrated and described in *Agricultural Gazette.* VOL.	PAGE.
Blue Grasses—									
Coast Blue ..	Andropogon affinis	C.	...	*	*	*	. . .	II	239
Tall Blue ...	,, refractus	C.I.	...	*	*	...	.... .	II	439
Blue	,, sericeus	I.	*	*	...	..	.	I	309
Mitchell Grasses	Astrebla pectinata	I.	*	*	*	..	... ..	I	311
Umbrella or Spider Grasses	Chloris truncata	C.I.	*	*	.	...	.. ...	II	24
	,, acicularis	I.	...	*	*	..	.. ..	III	147
Silver or Wallaby ...	Danthonia pallida	I.C.	*	*	...	.	.. ...	II	174
Egyptian Finger Grass	Eleusive ægyptiaca	I.	*	*	.	..	.. ..	IV	151
Love Grasses—									
Brown's ...	Eragrostis Brownii	I.C.	...	*	*	*	and later	XV	621
Slender Love	,, leptostachya	C.	*	*	..	..	...	II	241
Early Spring Grass ..	Eriochloa annulata	C.	...	*	*	..	......	III	856
Swamp Millet	Isachne australis	C.	..	*	*	..	Damp places.	III	233
Meadow Rice Grass...	Microlaena stipoides	C.	..	*	*	.	... ..	II	22
Panic Grasses—									
Australian Millet .	Panicum decompositum	I.	.	...	*	*	Swampy land.	III	641
Yellow-flowered	,, flavidum	I.	*	*	.		.. ...	IV	149
Mitchell's ...	,, Mitchelli	I	.	*	*		. .	.....	...
Water Couch...	Paspalum distichum	C.	...		.	*	and later	II	310
Tussock Grass	Poa cœspitosa ...	I.C.	.	*	*	*	,,	IV	524

Many other species could be added to the above list, but it would be necessary to take in hand such kinds as occur within reach of the operator unless he moved about to any extent.

Orchard Notes.

W. J. ALLEN.

SEPTEMBER.

THIS is a good month in which to plant citrus trees, but is rather late for planting deciduous trees and vines, even during the early part, yet such trees and vines can be planted if they are given special care. Cool, cloudy days are the best to select for planting, and the operator must avoid as far as possible allowing the roots to become exposed to the sun's rays or the wind. These remarks also apply to planting citrus trees, as where care is taken there should be little, if any, loss among the newly-planted trees. Careless handling is usually responsible for loss when such occurs.

In most of the drier districts it is best to see that all green crops are turned under this month, in order that they may become well rotted while there is still considerable moisture in the soil. If such crops are allowed to remain in until the land becomes dry it will be found almost impossible to plough the soil, to say nothing of turning them under, and the chances are that in place of doing good the opposite effect will result, as the moisture, in place of being conserved, will have been taken up by the crop, in consequence of which the soil will have become hardened, and when ploughing is attempted the ground will break apart in lumps and it will be found impossible to turn the crop under, which will thus dry up instead of rotting as it should. If rain should not fall it will be found almost impossible to bring the land to a proper tilth, and owing to the absence of moisture in the soil the trees will in all probability suffer severely during the summer months, and the fruit will be of little value as it will be undersized and flavorless. Therefore, in all dry climates, see that crops intended for turning under as a green manure are not allowed to stand too long before being ploughed under. In our coastal districts, where rains are of frequent occurrence, there is not the same probability of dry weather overtaking the fruit-grower, consequently he can take more risks than can his brother grower in the interior. If the spring proves to be a wet one it is advisable to spray any trees which have in previous wet years shown signs of fungus diseases, such as Peach Curl on the peach tree, Black Spot or Scab of the apple, Black Spot of the grape vine, and growers of the Gordo Blanco and Sultana will have to keep a sharp look-out and keep the spray-pump going, else the crops will be lost. Bordeaux mixture will be found the best spray at this time of the year for all fungus diseases. Should the San José scale put in an appearance after the leaves have started on the tree, the resin, soda, and fish oil wash will be found the best to use at this season of the year. Never spray any trees or vines while they are in

bloom, else the chances are the crop will be destroyed. They may be sprayed a week before coming into bloom and a week after the fruit is set.

Citrus trees may be pruned this month, and there are many orchards which would be greatly benefited by receiving a thorough pruning. Do not allow the lemon trees to grow high and willowy, but rather remove those tall weak limbs which are so often found growing up through the top of all lemon trees, and keep the tree lower, when it will be found much easier to spray, fumigate, and pick the fruit from it. Oranges and mandarins are generally benefited by a cleaning out from the centre of all superfluous and worthless limbs, twigs, etc. In every case see that the orchard is in thorough condition in every respect, as the future crop depends so much on the condition in which the trees and soil are kept during the spring and summer months. See to it, therefore, that no blame can attach to you if they do not make a good start.

ENQUIRER, Gulgong, asks what varieties of citrus trees would be the best to plant for home use in a district subject to frosts in winter but otherwise suitable?

MR. W. J. ALLEN, fruit expert, recommends Valencia Late, Siletta, Joppa, and Homosassa.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of September.

Vegetables.

From the beginning of this month forward, the weather is likely to become warm generally, and quite warm in some parts of the State; therefore, a great many different kinds of vegetables may be sown and planted with safety, even though some of these vegetables may be tender, and liable to be cut down by frosts. Gardeners are likely to find plenty of work to get through during the month in putting in their seeds, and planting seedlings which are ready for the planting.

As I write these notes in the railway train, I am passing through some beautiful fertile country, and have already travelled this afternoon more than 100 miles of the same kind of land and through farms, extending for miles and miles on each side of the railway line, and cottages every here and there, close enough to the line to form a good idea of the home surroundings, but I only saw a single vegetable garden, and only in one or two instances a few fruit-trees and a flower or two. The solitary vegetable garden is owned by a railway fettler, and as the train stopped for a short time close by, I had an opportunity of inspecting this garden. I counted seventeen small lettuces, and one or two cabbages. That was all. At the place I started from I went to an agricultural show, and was pleased to see some splendid vegetable exhibits—cauliflowers in the pink, or rather white, of perfection, fine cabbages, carrots, parsnips, with excellent and varied collections—showing what could be produced in the district. This made the total absence of vegetables seem all the more strange from the farms adjacent to 100 miles of railway or more; but the same thing, most unfortunately, holds good throughout the State. It is not that the farmers are unable from natural causes to grow vegetables, for here and there, but in exceptional cases, vegetables of much excellence may be seen. The general absence of home comforts, such as fruits, vegetables, and flowers, is much to be regretted for very many reasons, which need not be considered just now.

Of the tender kinds of vegetables which it is very desirable to grow as early as possible, and afterwards through the summer, the Kidney or French bean, the Lima bean, the Tongan bean, the Snake bean, and the Scarlet Runner, are amongst the most important. The tomato, too, ranks very high in general estimation. In the warmest parts of the State, tomatoes should be in bearing by this time. Where frosts have not been felt, old tomato plants have survived, and are bearing fruit again, and fresh plants have progressed well.

Last month the vegetable and flower directions were omitted by accident, as I was engaged in the country.

Asparagus.—Plant this at any time during the month; but, if the necessary plants are ready and to hand, they had better be set out as soon as possible, and then they are over and done with for years.

Bean—French or Kidney.—Sow a row or two twice or three times during the month, in drills about 2 ft. 6 in. or 3 feet apart for the dwarf varieties, and about 4 feet or more apart for the runners. Sow the seeds about 4 inches deep in the rows, and about 5 inches apart. One of the very best of the dwarf growing varieties is the Canadian Wonder, which has held its own against many new comers for years.

Mr. Ellis, Superintendent Howlong Viticultural Nursery, tried some new climbing runner bean seeds for me last season. Of Sutton's Princess of Wales he reports:—"This is an entirely new variety of climbing bean, of the highest merit, and a splendid bearer. The trials made have proved it to be one of the very best. Its pods are from 7 to 10 inches in length, fleshy and tender, and in appearance somewhat similar to a well grown Canadian Wonder. It is a great acquisition, and is sure to become a favourite. Height, 4 feet. Seed, brown in colour.

"Climbing French bean, Sutton's Tender and True.—A first-class French bean in every respect, somewhat similar to the above, fleshy and tender. Seed, vermilion in colour.

"Climbing French—Sutton's Earliest of all.—A good type of climbing bean, very early, and a very early bearer. Height, 4 feet. Seed, white.

"Runner Bean—Sutton's Abundance.—A tall runner bean of high merit, a sturdy grower, and a good cropper. The pods are long, fleshy, and tender; 8 to 12 inches in length, and 1 inch in breadth. Stands the heat well, is a fine show variety, and a great acquisition. Seed, white.

"Runner Bean—Sutton's Epicure.—A first-class climber and heavy bearer. Very fleshy pods. Only slightly affected by the extreme heat of the past summer. Very distinct. Quality not tested. Seed, brown.

"Scarlet Runners—Sutton's A1, Scarlet, Best of All.—Seed, speckled. Are three types of first-class runner beans; have evidently been selected from stock of the highest grade, in fact they are so good that it is almost impossible to say which is the best. They are all heavy bearers, and deserve a place in every garden.

"Runner Bean—Sutton's Tall Sugar.—A good climber; very prolific, and stands the heat well. Quality not tested. Seed, white.

"Dwarf French—Sutton's Perfection.—A very early variety, and an enormous bearer. Very fleshy, and of good quality. Seed, speckled.

"Dwarf French—Sutton's Plentiful.—A sturdy grower, and an enormous bearer of good quality. It is almost sure to become a favourite with market growers, and also with private growers whose garden space is limited. I consider that this variety and Perfection are two of the heaviest bearers in cultivation. Several of the plants grown here broke down with the weight of the crop. Seed, light brown.

"Dwarf French—Sutton's Monster Negro.—Although not such a heavy bearer as the above, I consider it one of the very best for private growers, or

with those with whom high quality is the main object. It is a very robust grower, and the pods are long, very fleshy, and of excellent flavour. The plants require to be grown from 10 to 12 inches apart. Seed, black.

"Dwarf French—Sutton's Triumph.—To all appearances a very good variety. Quality not tested. Seed, brown."

Bean, Lima.—Sow in all warm localities, or wherever there are not likely to be any late frosts. A very good variety is King of the Garden.

Beet, Red.—Sow seed about 1 inch deep, in drills about 18 inches apart, from time to time during the month. Thin out the seedlings well as soon as they have made two or three leaves. The beets thinned out may be planted in another bed, but they must be taken up carefully.

Beet, Silver.—This is one of the best of vegetables for summer. Sow a little seed in a seed-bed, and transplant when the seedlings are large enough to shift. Not many plants are likely to be required.

Cabbage.—Sow a little seed from time to time, and only sufficient to produce enough plants for small plantings. It is better to plant out small quantities occasionally than a large batch at one time. Make the soil very rich with good, rich, well-made manure—not too rank—and cultivate between the rows frequently. Frequent cultivation will do an immense amount of good to the cabbage, the cauliflower, and all the rest of this class of plants.

Cauliflower.—In the cool districts plant seedlings or plants that have been pricked out, and keep the cauliflowers growing without check from start to finish.

Carrots.—Sow a few rows, in drills, from 1 foot to 18 inches apart; cover the seed very lightly with fine soil.

Celery.—Sow a little seed in box or small seed-bed, and plant out good sized seedlings which may be ready; manure well, and plant in shallow trenches. It is a waste of time and quite unnecessary to dig out deep trenches for celery, for it can be managed just as well, if not better, certainly much easier, when planted in very shallow trenches, and it is only necessary to make even shallow trenches to allow of the plants being easily watered, or for the application of liquid manure. Try the best of the self-blanching varieties, and these can be completely blanched with but little trouble.

Choco.—Some vegetable growers like this vegetable, which grows somewhat like a pumpkin or cucumber, but needs trailling up wire-netting or fence, or some good support to enable it to grow to the best advantage.

Cucumber.—Seed may be sown extensively in all warm localities. Young plants raised for the purpose may be planted out, and they will soon make progress. Manure the soil well before sowing or planting. As the veins extend, pinch the ends, and this will induce growth of laterals.

Endive.—Sow a little seed, and plant out any seedlings that are large enough to handle, just as you would lettuce.

Leek.—Sow a little seed from time to time, and plant out from previous sowings. Sometimes if the weather is very dry lettuce is difficult to grow during the summer. To obtain the best results it should be grown without a check by using abundance of water and a good deal of liquid manure.

Melons, Rock and Water.—Sow seed in all warm localities as extensively as may be required.

Okra.—Sow a little seed in warm places, and afterwards transplant the seedlings to well-manured ground. They should stand about 2 feet apart. This plant is sometimes made use of for ornamental purposes in the flower garden, for it is very pretty when in full bloom.

Onion.—Be sure to grow some onions, for they are very useful indeed, and if good keeping kinds, such as the brown Spanish be grown, a supply can be kept for a considerable time in the house. Onions at time of writing are almost unobtainable, and the price is something terrible. If onions have already been raised in a seed-bed they should be transplanted out without delay. The soil should be made rich and surface fine where seed is to be sown.

Parsnip.—Sow a few seeds in well-dug land. The digging, or trenching which would be better, should be deep, for the parsnip is a deep-rooting plant, and needs the soil to be well worked, especially if the soil below the surface is at all stiff.

Peas.—Sow a row or two from time to time during the month.

Pepper or ***Capsicum.***—Sow seeds in a warm spot and plant out seedlings when large enough. If plants have already been raised plant out in all warm localities. Probably one or two plants will suffice for a family.

Potato.—Plant extensively of this useful vegetable. Select clean, smooth seed, and try several varieties to test their suitability for the climate, soil, and situation. Manure freely, plant about 5 or 6 inches deep, and cultivate the land frequently between the potatoes as soon as they appear above the ground. They should be planted from 2 ft. 6 in. to 3 feet or even more apart if the ground is very rich.

Pumpkin.—Sow a few seeds in well-manured land. Do not manure in holes, but spread the manure all over the space where the pumpkins are to grow.

Rhubarb.—Plant out early in the month and obtain some of the winter varieties in addition to the summer kinds. If plants for future use are likely to be required, sow a little seed, and in a year or two these should be quite large enough for planting out.

Tomato.—Sow seed in the open ground in all the warm districts of the State. Already in the warmest parts tomatoes are growing satisfactorily, and will soon be producing flowers and fruit. At the Wollongbar Experimental Farm, Richmond River, the gardener, Mr. King, tested several varieties of tomatoes for me. He found Dwarf Champion to be an excellent one, and well worth growing. The older and well-known Matchless he found to be wonderfully good in the district as it seems to be in other places. This tomato Mr. King considers to be one of the best to grow. For his tomatoes he applies liquid manure three times a week, twice with sulphate of potash, half ounce to the gallon of water, and once with nitrate of soda, one ounce to the gallon of water.

Turnip.—Sow a few seeds from time to time.

Vegetable Marrow.—Sow in same way as advised for pumpkin.

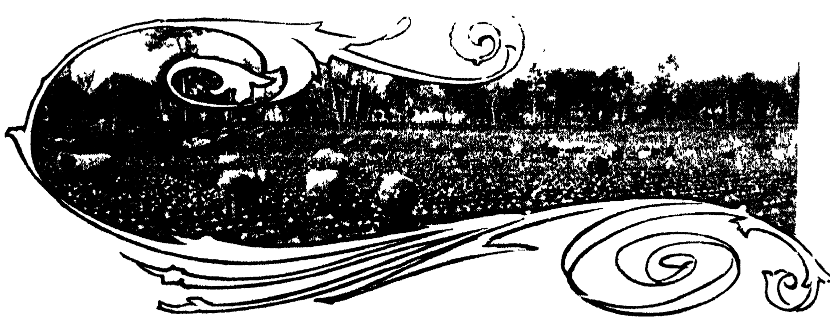
Flowers.

The garden should be bright with flowers of a great many varieties during this and succeeding months, should the weather prove at all favourable.

Seeds of tender annuals should be sown almost everywhere. Of these the balsam is one of the prettiest, if well grown. It needs abundance of manure and a good deal of moisture to enable it to grow to perfection. The zinnea will be found a useful annual, and the single varieties of dahlias treated as annuals will make a remarkable display if grown in clumps and are well manured. Seeds sown now will produce plants which will flower in the summer or early autumn.

Bouvardias may be planted out, and as they are most useful and beautiful plants when in flower, they should be grown everywhere.

Plant out pelargoniums, for they are also useful and beautiful plants. Petunias will make a fine show during the summer if seed be sown at the present time.



Farm Notes.

Hawkesbury District.—September.

H. W. POTTS.

THIS winter was a very dry one ; in fact, the rainfall was less than any since the last drought, and was in marked contrast to last winter when we had floods. We are facing the spring with a dry surface soil; fortunately the subsoil is comparatively moist, and with ample cultivation all crops will have enough to start them. Frosts prevailed all through the winter, during which over fifty were recorded. Fortunately the winter set in late and left an abundance of grass, so that the stock are in good condition. Every farmer has been busy getting the land into order for early spring sowing. Owing to the dry nature of the surface soil and the prevalence of severe frosts the sowing of several main crops has been postponed, also the planting of potatoes. This means that September will be a very busy month. It is recognised as soon as rain falls we will have a short hot spring, and the growth will be rapid for all crops.

Maize.—The staple crop of this district both for grain and fodder is maize. It provides the largest quantity of food per acre at the lowest cost. The climate and soil are suitable where the latter has not been worked out. This is to be reckoned with.

Complaints are frequently heard that the bottoms are not what they used to be for corn growing. Granted, and an inquiry will elicit the cause to be that crop after crop of maize has been grown, year after year, without any intervening crop to restore fertility and replace the annual drain of constituents the plant has withdrawn from the soil, or the addition of some fertiliser. The result is a foregone conclusion. The yields naturally are lessened. Maize is a gross feeder, and needs abundance of nourishment. No fertiliser will give the return of farm-yard manure when used at the rate of eight to ten loads to the acre. During the spring months it decomposes rapidly, and provides all the elements for full growth in the plant. This manure is especially indicated where there is an absence of humus. The humus contents of the soil so essential to good returns is invariably ample when the land has been previously cropped with any leguminous plant such as cowpeas, soy beans, lucerne, clover, vetches, lupins, peas, and beans. These not only provide organic or decayed vegetable matter, but also the most essential and expensive of all manures—nitrogen. Other crops provide humus of less value such as rape, wheat, barley, oats, or rye, and if fed off by sheep or pigs the additional manuring from the stock is an advantage. Failing these natural and profitable conditions then artificial fertilisers may be applied as in the following mixture :—

Superphosphate	5 parts.
Sulphate of potash	2 ,,
Dried blood	1 part.

averaging 1 to $1\frac{1}{2}$ cwt. of them to the acre.

The land should be brought to a fine condition of tilth by thorough cultivation. No effort should be neglected in preparing a good seed-bed after getting the subsoil into good texture and in an absorbent condition. The plant requires so much moisture during the rapid progress of its growth, that provision must be made for good storage under the seed-bed. Necessarily the natural condition of the soil and subsoil determines the character and extent of preparation.

Light sandy soils need more fertilisation, particularly in potash.

When sowing for a forage crop the aim is to select a variety likely to mature early and provide a heavy yield of leaf and green stalk either for stall feeding or ensilage. The most suitable are Improved Early Mastodon, Hickory King, Abercrombie, Red Hogan, Hawkesbury Champion, Iowa Silvermine, and Riley's Favourite. For grain sow Golden Beauty, Riley's Favourite, Hickory King, Pride of the North, Hawkesbury Champion, Iowa Silvermine, and Ninety-day.

Sorghum.—The crop next most suitable to maize for stock is sorghum for this district, seeing it is equally useful in the form of green food or as ensilage for cows, sheep and pigs. We have taken as high as 20 tons from 1 acre on only moderately rich land. Sorghum can be profitably grown on a class of land that would not be suitable for maize. It can be grown under a greater variety of conditions than maize, and is a more certain crop, especially during cold weather. A moist, clean, well cultivated seed-bed is as much needed for sorghum as for maize. The best fertiliser is farm-yard manure where organic matter is deficient. Otherwise 1 cwt. per acre—equal parts of Shirley's No. 1 superphosphate and bone-dust. The best varieties to sow are Early Amber Cane and Planter's Friend, in drills 3 feet apart—7 lb. to 10 lb. to the acre. Where the soil is rich a greater distance apart may be given. The early stages of growth should be keenly attended to. Shallow cultivation must be followed up to keep down weeds and retain soil moisture.

Potatoes.—Land to be used for potatoes requires the best attention. Deep ploughing, thorough cultivation, and rich manuring are essential. The best mechanical condition of the soil is the first consideration. The right class of fertiliser is well-rotted manure, turned in some time before planting, but as potatoes require large quantities of potash, it is necessary to add it in case the soil is deficient. Mr. Guthrie advises the following mixed fertilisers. These have been used in this district with good results:—

		Costing about £	s.	d.
Dried blood	400 lb.	1	0	0
Superphosphate	500 „	1	1	3
Sulphate of potash	220 „	1	8	0
	1,120 lb. = 10 cwt.	3	9	3

containing

Nitrogen	$4\frac{1}{4}$ per cent.
Phosphoric acid	$7\frac{1}{2}$ „
Potash	10 „

This should be utilised to the extent of about 6 cwt. per acre; the cost would be about £2 per acre.

A useful catch crop following a crop of potatoes fertilised in this way will take up the remaining manure. The planting season this year has been delayed owing to the absence of rain and the prevalence of frosts, and imposes additional work this month. Seed potatoes have risen in price. The best early varieties to plant are Early Rose, Beauty of Hebron, Bliss's Triumph, Medium, Ruby, Bresse's Prolific, Cambridge Kidney, Brownell's Beauty, Manhattan. Other varieties worthy of trial are Northern Star, Early Northern, Up-to-date, Aroostook Company's Prize, Dakota Red Pride of the South, and Green Mountain. On light sandy soils Aroostook, Up-to-date, Beauty of Hebron, and Early Northern give the best yields.

Millets.—For forage the best varieties to grow are Hungarian and White French. They provide a green succulent class of food at a time when summer begins to affect the grass, and before sorghum or maize are available.

Mangolds and Sugar Beet.—Sow these early in the month. The land should be deep and rich and heavily manured. Mammoth Long Red does best on deep loams, and the Yellow Globe on light sandy soils.

Pumpkins, Melons, and Winter Squashes.—These may be planted out this month. Water melons realise the best returns when planted early. Where pigs are fed attention should be given to the growth of pumpkins, squashes, and grammas.

Artichokes.—These afford a special class of food for sows after suckling a litter. They act as a tonic and diuretic as well as food. The crop is a payable one and deserves more attention. Deep cultivation is required with a well-manured soil.

Cowpeas.—This crop is yearly becoming better recognised both as fodder or as a soil renovator. It stands unrivalled during the very hot period of the summer as a green feed for cattle, sheep, and pigs. In our light soils it forms a most important crop in the rotation to increase nitrogen and add humus. Where the aim is to grow seed the white variety gives the best returns. For fodder or for green manure the best sorts are Black, Clay-coloured, Whip-poor-Will, and Warren's Extra Early.

Riverina District—September.

G. M. McKEOWN.

Potatoes.—Planting should be completed as early as possible, where there is no risk from frost. In dry districts, early varieties will give the best results. Flat cultivation will be found to answer best where the sets have been planted at a proper depth, which should be about 6 inches. The operation of hilling always cuts a number of roots, and exposes too much surface earth to the drying effects of sun and wind. The land between the rows should be cultivated during the growth of the crop by means of a Planet Junior, horse-hoe, or hand-hoe.

Pumpkins and Squashes.—Sow, as soon as danger from frost is past, on a site as free as possible from this risk. Early plants are frequently cut off by late frosts, and fruit which sets late is prevented from maturing by the occurrences of early autumn frosts. Free soils of good depth, and containing a good supply of vegetable matter, will give the best results, The land should be deeply worked, brought into fine tilth, and well dressed with stable manure. The seed should not be sown in raised mounds, but in slight depressions, so as to catch all the moisture possible. To prevent surface baking and evaporation of moisture, the parts in which the seeds are sown should be liberally mulched. For table use, the following will be found satisfactory, viz. :—Early Orange Sugar, and Japanese pumpkins ; Pike's Peak and Delicata squashes ; and Long Green and Long White Bush marrows These will give good results under good cultivation without irrigation, but some of the best varieties, such as Ironbark, Crown, and Button require irrigation to produce satisfactory crops. Sow running varieties 10 feet, and bush kinds 6 feet apart.

Melons.—The land should be deeply worked and, if possible, subsoiled after a good dressing with stable manure. Apply to each group of plants about 200 lb. per acre No. 3 manure. Water melons should be sown in the manner advised for pumpkins, care being taken to avoid a raised surface. If sown 10 feet apart, cultivation may be carried out by means of Planet Junior hoes throughout the growth of the crop. Rock melons, which give more satisfactory results in dry districts, should be sown about 6 feet apart. The following are good varieties, viz. :—Water melons : Santiago, Dixie, Kleckley, and New National. Rock melons : Hackensack, Pineapple, Chicago Market, and Chesmeh. Cattle melons will give good yields in ordinary seasons.

Sorghum.—Sow when risk of frost is past. The best sites for the crop will be found on low flats with a good soakage from adjacent hills, as our summer is too dry for good results from high situations with shallow soils. For cultivation where irrigation is not possible early varieties, such as Saccharatum and Amber cane, will give the best results. Where it is possible to use water, the Planter's Friend will yield the heaviest crops ; but it cannot be forced by this means, it is liable to be caught by early autumn frosts. Seed should be sown in drills at about 3 feet apart, the quantity required being about 8 lb. per acre. Sowing can be done with an ordinary wheat drill by placing a board over the seed cups, with openings cut over the required tines. Prior to sowing, the land should be brought into fine tilth, and during the growth of the crop the spaces between the rows should be cultivated with Planet Junior or other horse-hoe.

Vegetables.

Sow French and Lima beans where it is possible to water thoroughly.

Transplant tomatoes into well prepared beds, providing some shelter against frost till risk is past.

Clarence River District—September.

T. WALDEN HANMER.

THE drought continued well into August, and retarded farming operations pretty considerably, consequently crops will be late, and numbers of farmers very much behind in planting corn, &c.

Potatoes.—If any sets are still on hand plant them out with as little delay as possible. We are trying the famous "Northern Star" variety, with other standing varieties, this season at the Grafton Experimental Farm.

Onions.—The onion plot will require a great deal of attention this month in order to keep down weeds, and probably they will require thinning out.

Lucerne.—Although getting late, lucerne may still be planted this month where the soil has been properly tilled, and where there is sufficient moisture. The value of lucerne cannot be too highly impressed upon farmers, large or small.

Maize.—Sow maize this month, and on land that has been successively planted with maize a number of years, an application of bone-dust will be found very beneficial.

Pumpkins and Squashes.—All danger of frost should be over in this district now, and pumpkins and squashes safely sown. Of pumpkins the True Ironbark, Button, and Crown are among the most favoured for table purposes, and Anderson's Mammoth for cattle. Moore's Cream, Long White Bush, Essex Hybrid, and Custard are excellent squashes.

Melons (Water).—Among the best are Cuban Queen, Fordhook Early, and Kleckley Sweet.

Melons (Rock).—Kirgegatch, Cassabah Long, Altum Bash, Golden Perfection, and Hackensack are delicious.

Sorghum.—This is a good month to sow sorghum; the best varieties are Amber Cane and Planter's Friend. Ten to 12 lb. of seed to the acre will be enough, if sown in drills, and 20 lb. if the seed be sown broadcast. The drills should be about 3 feet apart, and are to be preferred to broad-casting.

Grass Seed may be sown this month.

Sun-flower should not be forgotten by poultry-keepers, especially as fowls are very fond of the seed.

Pea-nuts, too, may be sown, and make an excellent feed for both poultry and pigs.

Keep the soil well stirred amongst all vegetables, as the dry winds from the west cake the soil on top very much after a shower of rain, besides which by keeping the top soil loose the moisture is very much conserved.

Glen Innes District—September.

R. H. GENNYS.

Oats may be sown for hay, as this is a very late district. Sow more thickly than earlier in the season, as this tends to bring the crop into head more quickly than thin sowing.

Millets, Sorghums, and Maize, for green Summer Fodder.—These may be sown in small quantities towards the end of the month, but there is still much danger of late frosts.

Potatoes.—Some early varieties may be sown, but it is not advisable to plant the main crop till much later.

Vegetables.—Plant out asparagus roots, also rhubarb. Sow cabbage, lettuce, celery, peas, radishes, carrots, and parsnips, and prepare the land for tomatoes, &c.

Harrowing and Rolling.—Directly after wheat is rolled in the spring, put the harrows on. Harrowing also is a very great benefit to wheats that are drooping, or not stooling too well. Wheat has very deep, tough roots, and there need be no fear of pulling much up, or injuring it by too much harrowing, - covering it up a little with earth and tearing it about seems to agree with it; harrowing conserve smoisture in the soil; in a dry time, it is wonderful the benefit the crop receives from this treatment.

The Relative Value of Cheese and Butter from the Same Quantity of Milk.

In answer to an inquiry *re* the relative value of cheese and butter made from the same quantity of milk, Mr. W. Graham, Instructor in Cheese-making, supplies the following information:—

Assuming the supply of milk to be 25,000 gallons, you should have 25,000 lb. of cheese. The cost of manufacture is, including wages, ½d. (half-penny) per lb. This last year the average price of cheese has been 6d. per lb.

Thus 25,000 lb. of cheese at 6d.	...	£625	0	0
Less cost of manufacture	...	52	1	8
		£572	18	4
against 11,100 lb., of butter, at 10d. per lb.	=	£462	10	0

Assuming that marketing of the cheese is the same as butter, there is a balance of £110 8s. 4d. in favour of cheese.

The cost of a cheese plant large enough for, say, 200 gallons per day, will run into something between £80 and £100.

Crown Lands of New South Wales.

THE following areas will be available for selection on and after the dates mentioned:—

H.S. or S.L. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
			FOR HOMESTEAD SELECTION.					
			a. r. p.		a. r. p.		£ s. d.	1905.
*979	Wagga Wagga	Mimosa	6,540 0 0	10	600 0 0 to 740 0 0	Coolamon, 13 to 15	10 18 10 to 12 6 8	28 Sept.
			FOR SETTLEMENT LEASE					
			a. r. p.		a. r. p.		£ s. d.	1905
*804	Glen Innes..	Glen Elgin and Morven	8,700 0 0	2	4,200 0 0 and 4,500 0 0	Glen Innes, 20 to 26; Dundee, 14.	43 15 0 and 46 17 6	7 Sept.
*803	Moree	....	8,205 0 0	2	3,807 0 0 and 4,398 0 0	Moree, 40 and 41 ..	31 14 6 and 36 13 0	7 ,,
*802	Tenterfield	Koreelah and Tooloom and Woodenbong (partly).	6,500 0 0	2	3,000 0 0 and 3,500 0 0	Killarney, 21½ and 23.	25 0 0 and 29 3 4	7 ,,
*806	do .	....	.	1	10,240 0 0	Tenterfield, 14 ...	32 0 0	7 ,,
*805	Walcha	....	.. .	1	3,250 0 0	Walcha, 34; Walcha Road Railway Station, 46.	27 1 8	7 ,,

* Available for original holdings only.

FOR IMPROVEMENT LEASE.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
				CENTRAL DIVISION.				
			a. r. p.		a. r. p.		£ s. d.	1905. Sale.
218	Condobolin	Crown Camp.	....	1	2,500 0 0	Ungarie, 16; Condobolin, 25.	5 4 2	12 Sept.
1357	Coonamble	Berida	....	1	2,156 0 0	Galargambone, 14; Curban, 2 to 3.	53 18 0	12 ,,
1346	Narrandera	Narrandera and Bundidgery.	....	1	2,880 0 0	Narrandera, 14	30 0 0	5 ,,
1358	Parkes	Goobang ..	....	1	1,080 0 0	Parkes, 8¼	9 0 0	12 ,,
1345	do	Burra Burra.	....	1	7,550 0 0	Condobolin, 35; Bogan Gate, 43.	31 9 2	19 Sept.
1350	Warren	Gillendoon	....	1	380 0 0	Warren, 15	7 2 6	Tender. 5 Sept.

For Conditional Purchase.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		a. r. p.			£ s. d.	1905.
Albury ..	Billabong	80 0 0	Germanton ..	Goulburn ..	2 0 0	19 Oct.
Armidale	....	160 0 0	Everett ..	Hardinge ..	1 0 0	12 ,,
,, ..	Lyndhurst (partly)	320 2 0	Aberfoyle	Clarke	1 0 0	5 ,,
Bathurst	....	660, 2,900, & 17,000	Gilmandyke, Groviland, &c.	Georgiana ..	0 13 4	21 Sept.
,, ..	....	1,860 0 0	Waltham and Piper	Roxburgh	0 13 4	21 ,,
,,	....	1,480 0 0	Walton & Jedburgh	,, ..	0 13 4	21 ,,
,,	....	3,500 0 0	Turon	,, ..	0 13 4	21 ,,
,,	....	9,500 0 0	Dulabree and Jesse	,,	0 15 0	21 ,,
,,	....	784 0 0	Baring	Westmoreland	0 15 0	21 ,,
,,	....	667 0 0	Vittoria ..	Bathurst	1 0 0	21 ,,
,,	....	6,980 0 0	Stewart	Roxburgh ..	0 13 4	7 ,,
Casino*	....	335 0 0	North Casino	Rous ..	2 10 0	12 Oct.
,, *	....	190 0 0	Mongogarie	Richmond	1 10 0	28 Sept.
Cootamundra	....	125 0 0	Wallendry ..	Bland	1 10 0	19 Oct.
,, & Gundagai.	... .	210 0 0	Wantiool ..	Clarendon ..	1 5 0	12 ,,
Corowa	Boomanoomana .	627 0 0	Lalalby ..	Denison	2 5 0	12 ,,
Gosford*	....	61 1 0	Tuggerah	Northumberland.	4 0 0	7 Sept.
Goulburn	....	560 0 0	Marulen and Bibly-rambija.	Argyle ..	0 6 8	5 Oct.
,,	....	4,468 0 0	,, ,,	,, ..	0 8 4	5 ,,
,,	....	350 0 0	,, ,,	,,	0 10 0	5 ,,
,,	....	234 2 0	Wologorong	,,	0 16 8	5 ,,
,,	....	475 1 0	,,	,,	1 15 0	5 ,,
Gundagai	Nangus (partly) .	1,230 0 0	Mitta Mitta, Burra, &c.	Clarendon & Harden.	0 6 8	7 Sept.
,,	,, ,,	700 0 0	,, ,,	,, ,,	0 10 0	7 ,,
,, and Cootamundra.	. .. .	8,400 0 0	Burra and Muttama	Harden	0 8 4	28 ,,
Gundagai	.. ..	210, 1,500, 256, 1,160 & 835	Burra	,,	0 8 4	28 ,,
Gunning ..	... .	100 0 0	Gunning ..	King .	1 5 0	12 Oct.
Hay ..	.	526 0 0	Tongul .	Waradgery	1 5 0	21 Sept.
Inverell	Cope's Creek	200 & 1,330	New Valley and Cope's Creek.	Hardinge .	0 15 0	21 ,,
,,	.. .	217 0 0	Weean ..	Arrawatta	1 6 8	7 ,,
Maitland* ...	. .. .	80 0 0	Heddon .	Northumberland.	1 0 0	12 Oct.
Narrandera ..	. . .	304 0 0	Brobenah ..	Cooper .	1 0 0	19 ,,
Orange	. .	164 0 0	March ..	Wellington .	1 5 0	19 ,,
Parkes	. ..	536 2 0	Gillenbine .	Cunningham	1 0 0	28 Sept.
Port Macquarie*	. .	380 0 0	Ballengara ..	Macquarie .	0 15 0	28 ,,
Rylstone	. ... .	8,000 0 0	Pomany, Simpson, and Widdin.	Phillip .	0 11 8	21 ,,
,,	. ...	30,000 0 0	,, ,,	,,	0 15 0	21 ,,
,,	......	10,000 0 0	,, ,,	,, ..	0 16 8	21 ,,
,,	....	1,200 & 1,950	Stewart ..	Roxburgh .	0 13 4	7 ,,
,,	. .... .	90,400 0 0	Hawkins, Dabee, Rumker, &c.	Phillip .	0 15 0	7 ,,
Stroud* .	. .. .	860 0 0	Bindera .	Gloucester ..	1 0 0	28 ,,
Tamworth	Wombramurra ..	350 0 0	Wombramurra ..	Parry .	0 15 0	21 ,,
Taree .	. .	152 0 0	Wang Wauk	Gloucester ..	1 0 0	5 Oct.
Tenterfield	.	2,820 0 0	Gore and Koreelah	Buller .	0 13 4	7 Sept.
,, ..	. ...	90 0 0	Tenterfield .	Clive	1 0 0	12 Oct.
Tumbarumba ..	. .....	228 2 0	Courabyra ..	Wynyard .	0 10 0	21 Sept.
,,	. .. .	869 2 0	Goldspink	,,	0 5 0	21 ,,
,, ..	Jingellic	142 0 0	Jingellic East	Selwyn ..	0 10 0	7 ,,
Tumut	. . ..	130 0 0	Batlow	Wynyard .	0 8 4	12 Oct
Warren	Eenaweena	50 0 0	Narrar .	Oxley .	1 5 0	12 ,,

* Available for original holdings only.

Special Area.

Cootamundry Land District, 447¾ acres, in parish Cootamundry, county Harden; maximum area, 50 acres; minimum area, 40 acres; price, £2 to £4 per acre. Available for original conditional purchase only on 19th October, 1905.

Parkes Land District, 664 acres 2 roods in parishes Currajong and Parkes, county Ashburnham; maximum area, 81¼ acres; minimum area, 28¼ acres; price, £1 10s. to £3 10s. per acre. Available for original only on 5th October, 1905.

(Signed) ROBERT McDONALD,
Acting Under Secretary for Lands.

AGRICULTURAL SOCIETIES' SHOWS.

1905.

Society.	Secretary.	Date.
Young P. and A. Association	Geo. S. Whiteman	Sept. 6, 7
Albury Annual Show	Walter J. Johnson	,, 12, 13, 14
Manildra P. and H.	E. J. Allen ...	,, 13
Wyalong District P., A., H., and I. Association ...	S. G. Isaacs ...	,, 5, 6
Northern Agricultural Association (Singleton) ...	C. Poppenhagen ...	,, 13, 14, 15
Yass Show	W. Thomson ...	,, 14, 15
Berrigan A. and H. Society	G. Hamilton ...	,, 20
Cowra P., A., and H. Association	F. P. Fawcett ...	,, 20, 21
Germanton P., A., and H. Society	Jas. S. Stewart ...	,, 20, 21

1906.

Society.	Secretary.	Date.
Albion Park A., H., and I. Society	Henry Tryer ...	Jan. 17, 18
Wollongong A., H., and I. Association (Wollongong)	J. A. Beatson ...	Feb. 8, 9, 10
Walcha P. and A. Association	S. Hargrave ..	Mar. 7, 8
Tenterfield Intercolonial P., A., and Mining Association	F. W. Hoskin ...	,, 6, 7, 8
Fair days	... .	,, 9, 10
Gunning P., A., and H. Society	Ernest E. Morgan	,, 8, 9
Berrima A., H., and I. Association (Moss Vale) ...	James Yeo ...	,, 8, 9, 10
Camden A., H., and I. Association	A. Thompson ...	,, 14, 15, 16
Newcastle and District A., H., and I. Association...	Owen Gilbert ...	,, 15, 16, 17
Crookwell A., P., and H. Association	C. T. Clifton ...	,, 22, 23
Tamworth Agricultural Association	J. R. Wood ...	,, 27, 28, 29
Warialda P. and H. Association	W. B. Geddes ...	April 4, 5, 6
Richmond River A., H., and P. Association (Casino)	E. I. Robinson ...	,, 5, 6
Hunter River A. and H. Association (West Maitland)	C. J. H. King ...	,, 24, 25, 26, 27, 28
Orange A. and P. Association	W. Tanner ...	,, 25, 26, 27

[2 plates.]

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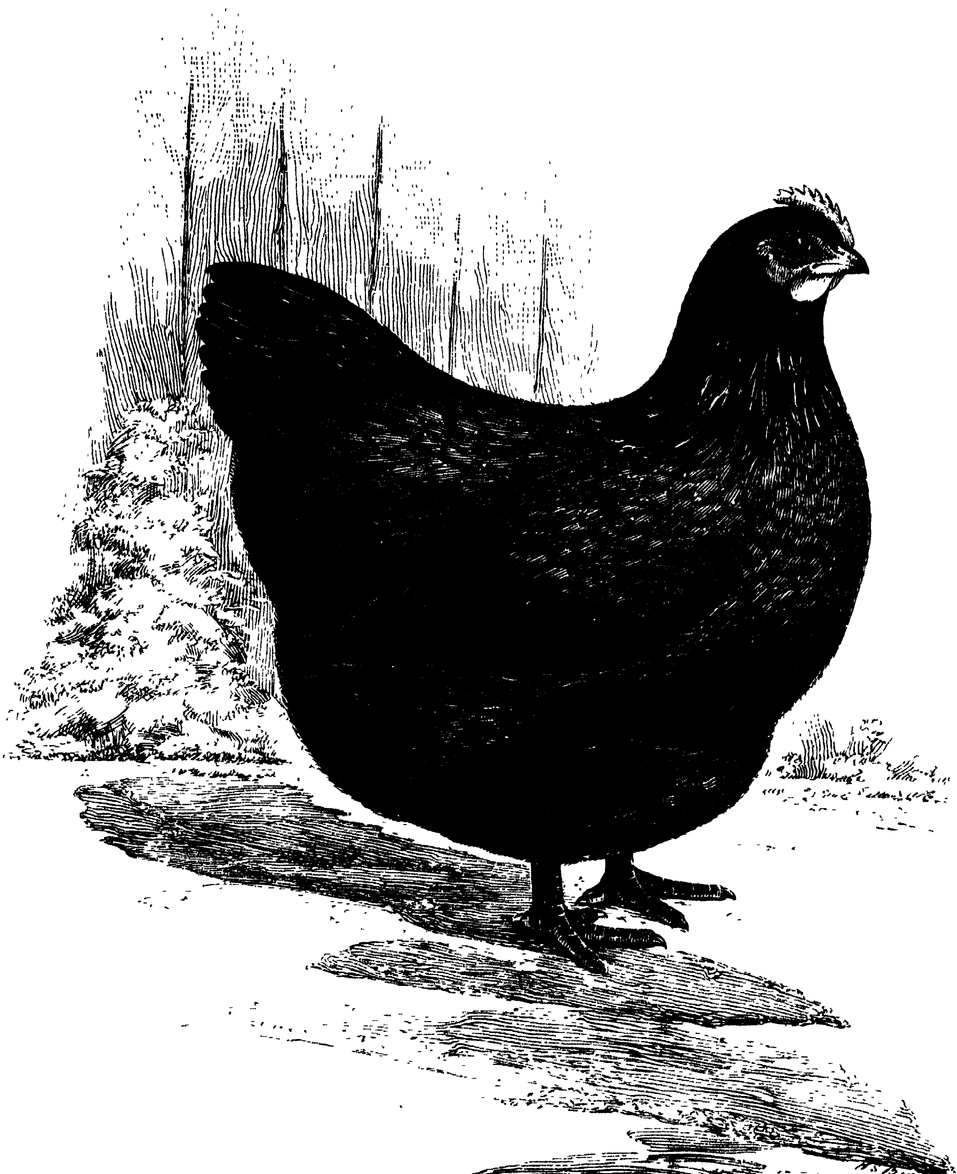


TYPICAL BLACK ORPINGTON.

Farmers' Fowls.

[Continued from page 878.]

G. BRADSHAW.

CHAPTER XVI.

ORPINGTONS.

Shows, &c.

IN connection with the good qualities of the old breeds, and the admitted deterioration, through over-showing or other causes, the opinions of the late Mr. Comyns are worth reproducing. Mr. Comyns was an exhibitor, reporter, judge, lecturer, &c., and for several years Secretary of the English Poultry Club (was my own nominator for membership of that club in 1884, a coincidence being that the late Mr. W. Cook, the man who made the Orpington, was also nominated at the same meeting). In fact, Mr. Comyns occupied every honourable position which the fanciers' poultry world of late years offered, and was of all others competent to speak of its results. In 1886 Mr. Comyns was engaged to deliver a series of lectures on poultry-keeping, under the auspices of the Institute of Agriculture, at the Museum of Geology, London, and, though editor of a fanciers' paper, pluckily introduced the subject as follows:—

"Throughout France poultry are almost universally kept for one of two purposes, either to lay eggs, or to fatten for the table. In England, on the other hand, a very large proportion of the poultry are not kept for either of these purposes, but to gratify the taste or 'fancy' of their owners. It is here, I think, that one of the gravest causes of want of success in poultry-keeping in England is to be found. There are no statistics of poultry-keeping in England available, but I hardly think I am beyond the mark in saying that more than one-half of the poultry of this country are either themselves fancy birds or immediately descended from such. Some of my readers know perfectly well what I mean by fancy birds, but, as I am here to instruct those who do not know, I will explain my meaning.

"In this country there are some hundreds of poultry shows in the course of the year, where prizes are offered for the various breeds. At these shows the birds are judged according to certain standards, which have in the course of time come to be accepted as the ideal of perfection of each breed. You will understand this better later on, when I come to describe the points of various breeds, but I may say here that these points of perfection are, as a rule, arbitrary and useless in themselves, from a practical point of view, as could well be imagined. Feathers—laced, pencilled, spangled, barred, striped, &c.;

combs—single, double, triple, rose, horned, and several other sorts; legs—feathered, bare of feather, yellow, black, blue, green, white.

"All these points have their value, and no slight value, in the estimation of the fancier. I have been a fancier, and have found it a most engrossing occupation or amusement; and I do not for a moment mean to say a word against fanciers as such. They have undoubtedly in some respects benefited the poultry-keepers in the country, but it is manifest that their pursuit in itself is of as little practical utility as would be the desire of a dairy farmer to produce cows with their horns twisted three times round, or some other similar arbitrary point not in itself an indication of purity of race. As an amusement, or as a pursuit from which money may be made, poultry-fancying is desirable and beneficial; but it is manifest that in the pursuit of all these fancy points the useful is sure to be lost sight of. What is necessary for the practical poultry-keeper is a breed of fowl which lays the largest number of eggs in the shortest possible time, and which will fatten readily and be of good quality on the table. The poultry-fancier, in the pursuit of his lacing, pencilling, &c., is obliged to make such a trivial matter as laying a very secondary consideration."

Mr. Tegetmeier, F.Z.S., editor of *The Field*, and author of "Profitable Poultry" and other works on this subject, and a judge of table poultry at most of the leading English shows, says:—"I have seen with regret the steadily increasing tendency of poultry shows to encourage mere fancy varieties, and to ignore altogether the profitable value of the birds exhibited. This has gone on to such an extent that I do not hesitate to affirm, as the result of my experience of half a century, that no one breed of fowls has been taken in hand by the fancier that has not been seriously depreciated as a useful variety of poultry. Further, what I object to is that fancy poultry should, in this country at least, take the place of useful birds that are fitted to supply the markets with poultry and eggs, for, as at present conducted, fancy points only have to be considered by the judges, the result being that the economical value of many breeds has been entirely lost. For example, Spanish, from being abundant producers of large white eggs, have become very indifferent layers, some of the notorious prize winners being sterile. Cochins on their introduction were good layers, and are now the worst. Dorkings, that formerly supplied the best fowls for London markets, are now bred as show-birds, and are not equal to Surreys. Game, formerly bred for table fowls, are now elongated out of all knowledge, and look more like the waders of the ornithologist. I wish to show that for economical purposes it is absolutely necessary that such views should be set forth, for at the present time our agricultural societies are doing what I conceive to be considerable injury by giving prizes for useless birds, and ignoring to a great extent breeds that would be of benefit to the farmer and the nation at large."

Mr. Edward Brown, a well-known English expert, whose specialty is table poultry, commenting upon the difference between the English and French show systems, says:—"English fanciers' shows are not established for the improvement of poultry in their economic

qualities, but for fancy points. The judge regards as all important shape, size, colour, comb, legs, and general contour, and does not care whether the fowls are likely to make good table fowls or first-rate layers. In France the judging is exactly reversed. The points which denote economic qualities are looked for first of all, and then an examination made for externals. They know that birds which have special characteristics are best, either as layers or on the table, and thus they look out for these points, and breed to them."

Mr. Consul Gurney's Report on the Agriculture of the Cherbourg District, France, presented to both Houses of Parliament, ran as follows:—"The agriculturists of Western Normandy, having given up cereals, now get a very fair return for their capital and labour out of dairy-farming, poultry-rearing, and market-gardening, and London furnishes them with a profitable market for their butter, turkeys, geese, and poultry. Their fowls are carefully tended, and, having the free run of the grazing fields and the cider apple orchards surrounding the farmstead, add largely to the profits of the farm. Fostered by shows which are based upon the fallacious principle of breeding for feather only, a grievous mistake from a practical point of view, poultry-keeping in England has become too much of a fancy, benefiting only prize-winners and opportunist poultry-breeders catering for the newest fad in shape and colour."

These quotations could be supplemented to an almost indefinite extent from the fanciers and fanciers' press of both England and America, but I will content myself and conclude with the following from a pamphlet entitled "Poultry and Eggs for Market and Export," by a former expert to the Department of Agriculture, New Zealand:—"It must not be presumed that a bird that takes first prize at a poultry show is the best bird for the farmer. It may be the worst. Most of the pure-bred birds in this country are of the fancy class, and have been bred for showing only. They are deteriorated in useful qualities by in-breeding, by breeding from birds known to be poor layers, or weakly, because they show good points in feathers. The result is a loss in constitution; the birds themselves are subject to disease, and their chickens hard to rear. The egg-producing qualities have suffered even more. Many breeds once noted for laying have lost their good name through fancy breeding. Keeping back pullets from laying in order to increase their size is often practised by fanciers, and has a depressing effect on fecundity."

All the handicaps to profitable poultry-breeding as enumerated in the above extracts were well known, but the usual apathy of breeders allowed this state of things to continue, until the late William Cook conceived the idea of producing a breed with constituents calculated to stamp it as one of the very best for commercial purposes, and that while amenable to "improvement in appearance" by fanciers, would be by its colour and constitution, able to withstand all the effects for ill to which other varieties have been subject, and whether the big black fowl originated by him, and named after the town in which he then lived, was one of the best commercial, and despite exhibiting continues so, is one of the purports of this paper to show.

Of the many varied regrets indulged in by writers on the injury done to commercial poultry by hobbyists, the majority are to the effect that fancy and utility should, or could, be combined in such a degree that fowls, when put in the exhibition pen, could be awarded prizes on the same principle as that of other stock. A judge, when making awards in the Ayrshire cattle class, first looks for the points which indicate purity of breed, and as the commercial character of this breed is a big milk yield, the judge then looks for the development of certain organs which are associated with and indicate a liberal milk supply. The same in breeds noted for beef qualities; type is looked for as an indication of the purity of the particular breed, and then the great muscular development and big square frame on which to build this meat. Sheep are judged in the same way for wool or meat, certain indices pointing to a superiority in either, *i.e.*, commercial superiority. Not so with poultry, for, as has been frequently said, the champion hen, although perfect in all the points of her breed, may not be capable of laying an egg, while the first prize rooster may be useless in reproducing his species. This brings me to the "utility and fancy combined," and from much research in the vast tract of American poultry literature, there is not a doubt but the Yankees have to a great extent combined the two. Their judging standards are not of the arbitrary nature of those adopted in England, and which we faithfully follow here, with the result that although the American prize birds in many breeds could not win, judged by our standards, at the same time the purity of race is much more pronounced than with us, many of their breeds being pedigreed for over a quarter of a century, the Felch and other bloods being as faithfully perpetuated and as familiar in certain breeds of poultry as the "Bates" in English shorthorns, the above pedigreed strains being noted for their great laying qualities as well as their show-pen excellencies, while other breeds not only retain the economic qualities which accompanied them upon their introduction, but have improved in usefulness, while the same breeds under our system have been improved almost out of existence. Brahmas, which for their unproductiveness have now but few patrons here, are among the most prolific layers in America, following closely on the Wyandotte for popularity. Plymouth Rocks, which have scarcely a dozen breeders in this State, are only second to Wyandottes in that country in popularity, and form the bulk of the American export poultry trade to England.

There are a number of breeders in England who advocate that a system might be adopted of judging commercial qualities by appearance, as in other stock, the specimens whose appearance indicates the greatest laying capacity or the best flesh-formers to be awarded the prize; in other words, a combination of the beautiful from a fancier's point of view, and the economic from the commercial standard. Thanks, however, to the laying competitions incepted here, and now general throughout all the Australian States, it is being abundantly proved that under the present English Poultry Club standard as used in Australian shows, the utility and the fancy side of poultry can, and is, being combined, and that in more than

one breed or variety which made laying records included specimens of the best exhibition type and colour of their respective breeds; and there cannot be a doubt but that should these competitions continue, and patrons of the various breeds look after the appearance as well as the performance of their birds, ere long the combination of the fancy and utility side of poultry-keeping will be an accomplished fact; and so far as the breed which gives the title to this paper is concerned, for whatever or all purposes required, the performances and records already made conclusively prove that exhibition and useful qualities can safely be combined in one breed.

Chapter XVII.

Justification for New Breeds.

In the preceding chapters I have shown that the majority of the poultry productions of the past fifty years were heralded on their introduction as superior in some commercial essentials to their predecessors; that those who tried them, and the most competent authorities of the day subscribed them as superior, and just as sure in later years did the majority of these breeds, in an economic sense, come to grief, the show-pen system receiving credit for their retrogression. An article in a leading fanciers' paper on this subject I think worthy of reproduction:—

"Those who have much experience in poultry-keeping are aware that although the laying qualities of various breeds are capable of being described as good, bad, or indifferent, this description by no means universally applies to individuals or families of the breed. Even in breeds which are known as very good layers, some birds will be found which are far below par in this respect; while in breeds noted for their poor laying qualities, exceptional birds sometimes produce wonderful results.

"This divergence has its origin, we think, in the fact that birds are in this country bred from two perfectly distinct, and, to a certain extent antagonistic, objects. On the one hand, the poultry fancier is striving for perfection in colour and marking, for size, and for other fancy points. This aim he pursues quite without regard to the laying qualities of the birds selected to be bred from. It may be that the best fancy bird is a bad layer; but none the less the few eggs she lays are treasured and hatched out in preference to those of any other bird in the yard.

"This alone materially affects the laying qualities of many prize strains. In addition to this, however, in those breeds in which size is an object, exhibitors actually take means to prevent the early laying of the pullets. It is found that upon her commencing to lay, the growth of a pullet practically ceases for the time being. If this period can be delayed she continues to grow, and thus makes a better exhibition specimen. This is done by using non-stimulating foods, and moving the birds from yard to yard according as they show the

least symptom of attaining maturity and commencing to lay. A still further reason for deterioration is to be found in the fact that the best birds are sent much about from show to show.

"This, like moving from place to place, but to a much greater extent, retards laying. These processes being repeated from generation to generation, the laying qualities of almost all prize stock have been materially impaired; and it is only in exceptional instances that birds of prize strains are good layers.

"It is curious to note how, time after time, the latest novelty in the poultry world is hailed as the layer, and how, time after time, the laying qualities are gradually lost, and the supposed first-class layer loses its character in this respect even amongst its warmest votaries. As an illustration of what we mean, we may instance the Brahma and the Leghorn, both of which when introduced to this country had claims, and just claims, for pre-eminence as layers. Now the Brahma has almost universally lost its character as a layer, while the Leghorn is just hovering between the character of a good layer and a bad layer, according to the particular strain which is kept. On the other hand, there are throughout the country a few (though far too few) persons who regard laying qualities as of primary importance, and who, in the breeding of their stock, carefully keep that end in view. One breed or another may be selected for this purpose, and as purchasers from these strains find their birds are distinguished by good laying qualities, they rush to the conclusion that others of the breed are equally good in this respect. In this way the greatest diversity of results is obtained from different individuals of the same breed, and we see the curious spectacle of one poultry-keeper writing to say that he can only get eighty eggs a year from his Andalusians fed in such a way, while another hastens to reply that he keeps the same breed and gets 180 eggs per annum.

"Poultry shows have undoubtedly done good in establishing the pure breeds throughout the country; but poultry-fancying does harm, in that it casts abroad through the country strains of inferior laying qualities, and thus checks in many instances poultry-keeping on a small scale without any view to exhibition. The difficulties pointed out in this article materially affect the poultry prospects of the county."

The majority of people, realising the truth of the above, might very naturally be expected to condemn a system involving such disastrous results to the varous breeds. However, the fact remains that as deterioration has given the cue to some enthusiast who shortly appears with a new breed possessing the strongest of all claims to public recognition, the great handicap to all the hitherto productions being the fact that a universally good breed could not be kept an eternally good breed. This great drawback to the best breeds was to many of the poultry-keepers well-known, and more than one attempt was made to produce a fowl combining an excess of meat and egg properties, and adapt itself to the fanciers' art, without involving any decadence in usefulness. This ideal fowl, or at least, as near so as can within reason be expected, was at last produced, and from the

time it was sent out to the public in 1886 to the present day, has not only become the working-man's and the rich man's fowl, but has increased in popularity, and although taken in hand by the fancier, has not, like other breeds, deteriorated in useful qualities, but continues the same good all-round fowl as it left the hands of its originator, who named it after the village of which he was resident—Orpington (in Kent).

Originator of the Orpington.

Prior to 1883 poultry interests in England had no special journals, as now. Poultry show reports and poultry interests generally were looked after by the *Stockkeeper* and the then *Live Slock Journal*; but as dogs, pigeons, and other fancy stock found a place therein, little space was allotted to the fowls. A then, and yet, very popular weekly, *The Journal of Horticulture*, conducted by Dr. Hogg, LL.D., gave weekly insets devoted to poultry, amongst its contributors being the late A. Comyns, LL.B. The success of this section of the journal prompted the proprietor in making a new venture in the fanciers' world by starting a paper entitled *Poultry, Pigeons, &c.*, of which Mr. Comyns became editor. About, or rather, before this time, a good deal of correspondence had appeared relative to a man named Cook, who was making a great noise in the poultry world—not as an exhibitor or prize-winner, but relative to the keeping, breeding, and crossing of fowls for profit; and not content with that prominence, he actually published a book entitled "Cook's Breeder and Feeder; or, How to make Poultry Pay," many of the statements contained therein being of such a glowing nature relative to the possibilities of the business that he was ridiculed by the exhibiting poultry breeders.

Mr. Comyns, the editor of the new paper, on its introduction stated that the practical side of the poultry question, as apart from the fancy, would be a subject of much importance in its columns, and to that end he had carefully gone through Mr. Cook's book; and although the figures therein were startling, and the results of certain crosses also wonderful, the book was favourably reviewed; but to further test the accuracy of certain statements, Mr. Comyns visited the author at his then residence, Chislehurst, the following being his report:—

"Hostile criticism of Mr. Cook and his book, and incredulity as to his statements, had not been wanting, and we endeavoured, so far as lay in our power, to so frame our inquiries and make our investigations to test the accuracy or inaccuracy of the statements contained in the book, and the amount of credit to be attached to the author's statements.

"We must state, in the first instance, that Mr. Cook is a working man in the strictest sense of the term. He holds a situation in the employment of a gentleman, and resides himself, with his family, in a small house or cottage—one of a row of similar houses. He has been for years past a breeder of one sort or another of live stock, and has devoted special attention to the production of fowls remarkable for their laying qualities."

Mr. Comyns showed that in Mr. Cook's small yards there were a number of breeding pens, the male birds in each pen being mated to hens of a different breed, and consisting of Dorkings, Houdans, Game, Brahmas, Hamburgs, Minorcas, Cochins, and Plymouth Rocks. It will be noticed that one or two of the most popular varieties—Wyandottes and Orpingtons—are absent from Mr. Cook's list of crosses; but it must be remembered that Wyandottes, although then in England, were in such limited numbers, that in the year 1882 not a single show provided classes for that breed; and although a few specimens did appear in show pens, they were only to be found in that refuge for the destitute "any other variety" class, hence their absence in a small yard in Chislehurst need cause no surprise, while for Orpingtons, they were only issued to the public in 1886. Still, as Mr. Cook acknowledged several years labour in their manufacture, the progenitors of our Orpingtons were among the list of breeds or crosses then located in Mr. Cook's back garden, on the occasion of Mr. Comyn's visit as reported above; and whatever ambition or hope Mr. Cook then entertained in the way of making a new breed of black fowls, the name under which they became known could not then have entered his head, seeing that they were called after the village to which he removed in after years.

After the interview alluded to Mr. Cook became a regular contributor to the columns of *Poultry*, his articles being original and practical as well, and were highly appreciated by those breeders whose object was profit. Cook's blunt statements, new methods, and astonishing figures frequently provoked sharp criticism, but these affected the new poultry apostle for nought. He went on his way writing, lecturing, and otherwise propagating the then new doctrine of making a living from poultry. Cook's name was now becoming a household word amongst economic poultry-breeders, his small place and methods being always free to those who came to look for information. Nearing the close of 1883, two well-known fanciers visited his yards, and reported as follows:—"We were not at all prejudiced in Mr. Cook's favour, but rather the reverse. The appearance of the crossbred birds is not pleasant to a fancier's eye, lacking that uniformity of colour which is so desirable. What a pity it is we cannot combine the good, the useful, and the beautiful. We inspected the result of thirty crosses, but those that struck us most were Houdan-Minorcas, a square-shaped, short-legged, with rich black plumage. We were also shown a fine collection of eggs from the crosses, rivaling in size the Andalusian, and there were any number of them, for box after box was produced.

About July, 1883, Mr. Cook removed from Chislehurst to Tower House, Orpington, where he had more room for his poultry experiments, the increased accommodation and better breeding facilities affording him much more extensive experience, which was readily and freely given in contributions to the journal already referred to. One of his articles—Pure Breeds *v.* Mongrels—I think worth repeating here:—"What I want the people to understand is that birds may be pure-bred without having their fancy points developed to such an

extent as in the case of exhibition stock, and that these pure-bred birds may be bred with special regard to their useful points without allowing them to degenerate into nondescripts. I can assure my critics that it can be done, and that useful qualities so bred for can be established in pure breeds with far greater certainty than in any mongrels I have ever seen. Uniformity of appearance must also count for something. Those who bred for exhibition have done much good in the way of improving size, and those who go in for first crosses have done much in the way of meat and increased egg production. I do not say but that there are some decent birds to be found in the yards of mongrels; but I have never heard of anyone's yards being improved by these birds."

This, then, is a brief review and opinions of the man who a few years later put to the public a new breed of fowls of large size, combining the best qualities of the most desirable breeds, and one that inbreeding with its deteriorating tendencies need not be resorted to by fanciers to improve it for the show pen.

(To be continued.)

Blue-gum Spokes.

Some highly satisfactory tests of the strength and resisting power of Victorian blue-gum have just been made at the Engineering School of the Melbourne University. The samples were taken from the Apollo Bay forest. A piece, of 30 inches span and measuring 5 inches by 3 inches in thickness, that had been seasoned for seven years, withstood a strain up to 27,650 lb. Its weight was 63·6 lb. per cubic foot. A trial was then made with a piece of blue gum that had been part of a skid for five years and had been made into a spoke. It was tested as a column, the area of pressure being 2·04 square inches, and it bore up to 17,490 lb., or 8,573 lb. per square inch. Samples of oak and hickory tried at the same time showed resistance equal to 3,867 lb. per square inch and 4,065 lb. per square inch respectively. These tests of blue gum are remarkably satisfactory, and as there are in Victoria vast quantities of superior blue gum, it seems only a matter of time, when Australia will cease to be interested in the gradually-lessening supply of American hickory. Sufficient examples of the high qualities of Australian-grown timbers for wheels have already been seen to show that with a system of selection under which none but the very best grades of timber are used, spokes can be produced here at least equal to anything imported.—*The Australian Coachbuilder and Wheelwright.*

Mortality in Cattle caused by eating "Poison Tulip."

J. D. STEWART, M.R.C.V.S.,
Government Veterinary Surgeon.

DURING last month a serious mortality in cattle was investigated, which proved of more than ordinary importance to stock owners.

It appears that ninety-six head of cattle were mustered out of what is locally known as the "racecourse paddock," where they had been depastured for the previous six months, and driven through No. 2 paddock to the stock yards. There eighteen were drafted out for market, and passed into an adjoining paddock, No. 1, while the remainder were put back into No. 2 paddock, all being apparently in the best of health. On the following morning it was found that several of the drafted cattle had broken through the fence during the night and apparently rejoined the mob in No. 2 paddock. On searching for them the stockmen found three dead and several of the mob sick. It was, therefore, decided not to disturb the cattle. Within twenty-four hours ten more died and thirteen were noticed to be unwell. On my arrival next day an additional five had died, and sixteen were found to be affected, some of which subsequently succumbed. The total fatality was twenty-five.

On examining the affected bullocks at a distance, it was observed that many stood in a "propped-up" fashion, back arched and flanks tucked up. On being made to move, their hind quarters swayed from side to side in an uncontrollable manner, and often the hind toes were dragged along the ground, the animal being unable to bring the legs forward. In some cases the paralysis was so complete that when the animal rushed it fell, and was unable to rise again, although repeated struggles were made to do so. On closer examination, the muzzle was noticed to be very dry, the white of the eye changed to a dark red colour, pupils contracted, while the presence of severe abdominal pain was indicated by grinding of teeth, moaning, and repeatedly throwing the head back towards the flank. Occasionally the animal would lie on its side and stretch itself out with legs stiffened. The bullocks were too wild to take their pulse or temperature with any degree of accuracy. At the commencement of the mortality, death occurred within a few hours, but towards the end cases lingered two or three days, while a few that went down made a good recovery.

On death, decomposition set in rapidly. There was no discharge from nose, mouth, or anus, but the latter orifice was often found everted and inflamed. On making a *post-mortem* examination, the blood was found to be dark, and usually did not coagulate very firmly. There was a variable quantity of straw-coloured fluid in both the thoracic and abdo-

minal cavities. The lungs were engorged with dark blood, and the heart showed numerous dark-red extravasations, particularly beneath its lining membrane. The food in the third stomach was dry, and patches of

Poison Tulip (*Homeria miniata*).

extravasated blood were seen on the "leaves." The mucous membrane of the fourth stomach showed patchy congestion, and the bowels, particularly the small intestine, severe inflammation. The liver appeared unaltered, but the gall bladder was distended with dark-green fluid bile. There were some hæmorrhages under the kidneys, and the organs themselves were congested. The spleen was slightly enlarged and softened. The bladder contained a large quantity of highly-coloured urine, while its mucous membrane was slightly congested. The brain was also slightly congested. In the acute early cases, where the affected animal died within a few hours, Mr. Inspector-of-Stock Brooks informs me, the changes found were similar, but more pronounced. In one case he found the spleen much enlarged and softened, as is met with in anthrax, and blood was present in the lumen of the bowel. The bile he described as rather thicker and darker than that of the carcases I examined.

Bulb of Poison Tulip.

Microscopic examination of blood and of smears from spleen taken from a recently-dead animal failed to reveal the presence of micro-organisms, a result subsequently confirmed by cultural tests.

On examining the pasture in No. 2 paddock, patches of a plant known locally as the "Wild eschalot" were found. As this plant was recognised as belonging to a poisonous family, specimens were submitted to Mr. J. H. Maiden, Government Botanist, who identified it as *Homeria miniata*, or "Poison Tulip."

In order to prove beyond doubt that the tulip was the cause of the mortality, a small handful (3 oz. by weight) was chopped up finely, mixed with chaff and bran, and fed to one of the experimental heifers at Randwick Stock Quarantine. In six hours the animal showed signs of nausea, and in less than nine hours symptoms resembling those observed in the bullocks became manifest. For the following forty-eight hours the hind-quarters remained weak, the animal being very uncertain in movement. It is, therefore, evident that the tulip possesses powerful poisonous properties.

The fact that the heifer could not be induced to partake of a second quantity, although skilfully disguised in her food, explains the apparent immunity of stock that become accustomed to pastures containing the tulip.

In the *Agricultural Gazette* of February, 1904, Mr. Maiden, in referring to a specimen of bulbous plant said to have caused the death of some cattle, and forwarded for identification from Penrith district, and which proved to be the so-called Cape Tulip, mentions that it has been connected with the poisoning of stock in South Africa, Victoria, and South Australia. He also adds that: "Apart from the abundance of seed (and the capsules of the plant are full of it), it is propagated abundantly by the innumerable little bulbils (incipient plants) which the plant bears. I know of no means of coping with it, except by carefully digging it up before it seeds. It is a pretty plant, and is an escapee from gardens. Zealous war should be waged on it. It possesses a facility for getting the wrong side of the fence."


Flower of Poison Tulip
(Homeria miniata).

Mr. Maiden's description most aptly applies to the circumstances in connection with this particular case, there being evidence that the plant had escaped from a garden of an old homestead on an elevated portion of No. 2 paddock, and had gradually spread to the fertile flats.

Owners of pastures containing the plant should, therefore, lose no time in taking steps to eradicate it. When in small patches it can be taken out with a hoe as it appears each season, but once it establishes itself in a fertile pasture the only practical method of suppressing it appears to be putting the affected land under crop for a number of years.

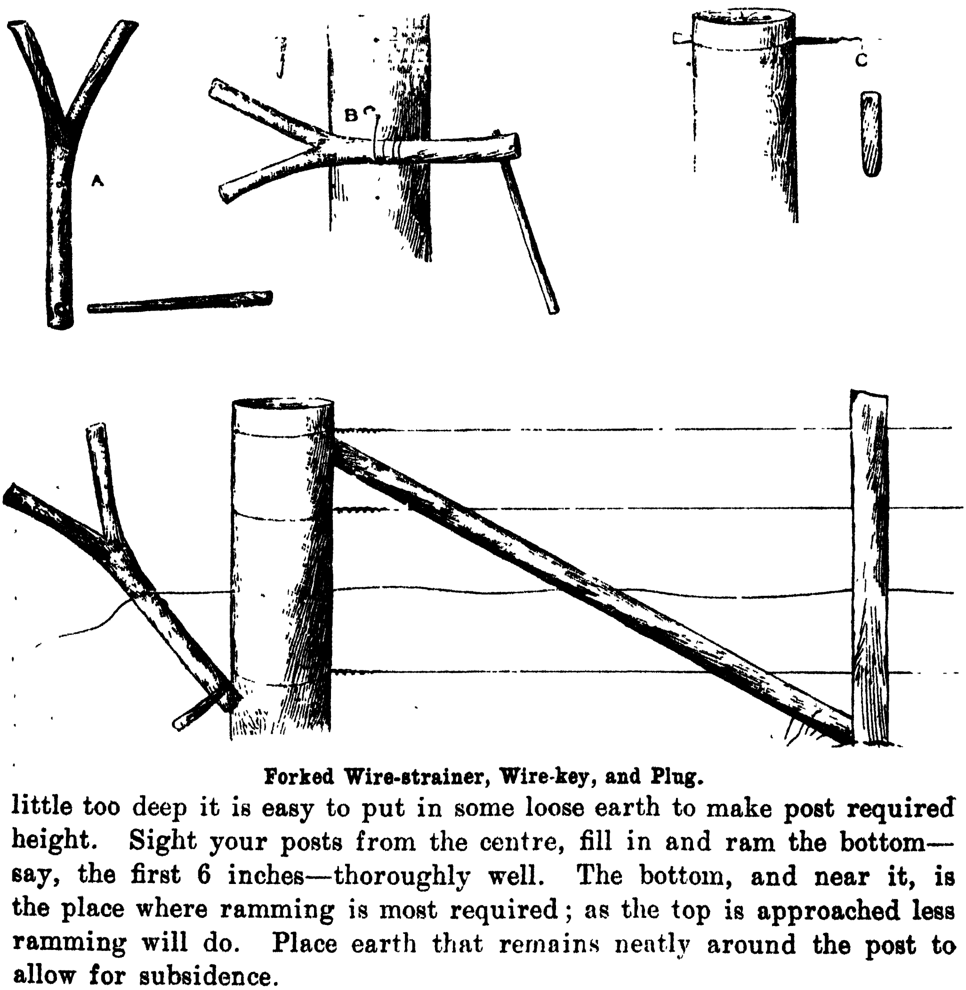
Some Hints on Fencing that may be useful to Settlers.

R. H. GENNYS.

IN putting up a wire fence only—supposing the timber is already laid on the ground—the first thing to do is:—

Digging Post-holes.

The holes should be from 22 inches to 24 inches in depth, and there is no necessity to make them too big, which involves unnecessary labour both in digging, filling, and ramming; besides, the post will not have such a firm grip in the ground. They should be a little more than large enough to receive the posts comfortably, and leave room for the rammer to work to bottom of the hole. Dig the full depth straight away; if a



Forked Wire-strainer, Wire-key, and Plug.

little too deep it is easy to put in some loose earth to make post required height. Sight your posts from the centre, fill in and ram the bottom—say, the first 6 inches—thoroughly well. The bottom, and near it, is the place where ramming is most required; as the top is approached less ramming will do. Place earth that remains neatly around the post to allow for subsidence.

The tools required for post-hole sinking are a medium-size iron bar with rammer head and chisel point, and a long-handled shovel. This latter tool should have a round nose and be bent inwards at the sides, so as to form a kind of scoop. Small post-holes cannot be dug with wide shovels.

Sink post-holes, if possible, when the ground is in good condition—not too wet and not too dry. Ground saturated with moisture is not benefited by ramming, and will set better without.

Erecting Posts for Wire Fencing only.

Split Posts.—The dimensions of which should be somewhere about the following:—8 in. x 4 in., with a face of not less than 4 inches, and 6 ft. 6 in. in length. Posts may be from 7 ft. to 12 ft. apart from centre to centre, but, where battens or droppers are used, may be further apart still.

Put all large and sound ends into the ground; place the posts into position so as to be quite firm, after the manner hereinbefore described under "Digging Post-holes."

Spacing and Boring for Sheep-proof Wire Fencing.

The following gauge for a 7-wire boundary fence has been found to be thoroughly reliable, and after a two years' test no stock have got out of it, with the exception of one beast that jumped over.

The height from surface of the ground to the top of the post is 4 ft. 6 in.

No. 7	wire	3	inches from	top of the post
6	,,	12	,,	No. 7 wire.
5	,,	9	,,	6 ,
4	,,	7	,,	5 ,,
3	,,	6	,,	4 ,,
2	,,	$5\frac{1}{2}$	,,	3 ,,
1	,,	$5\frac{1}{2}$	,,	2 ,,

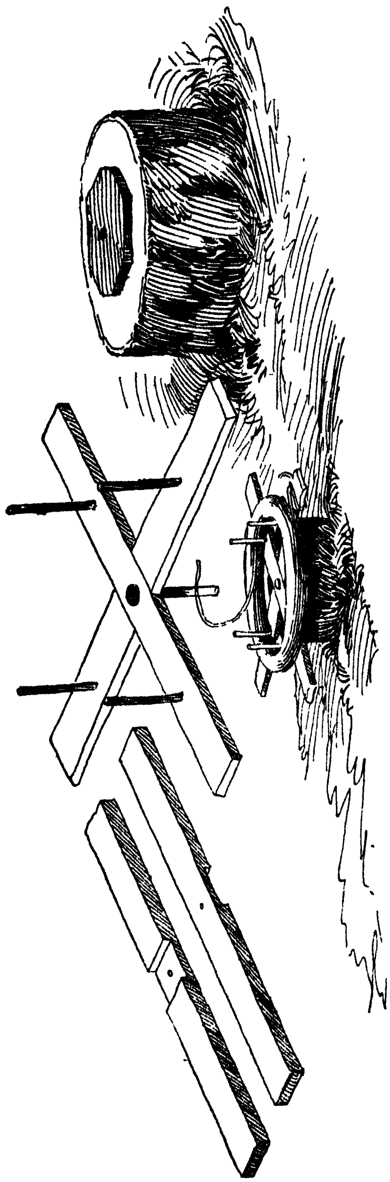
Surface of ground 6 inches from No. 1 wire.

When boring, use a $\frac{5}{8}$-inch auger, if No. 8 wire is to be used, and also battens; this will allow wire to run freely. If no battens used, $\frac{1}{2}$-inch auger will be large enough. Bore straight and right through, so as to push out anything that may impede easy threading of the wire.

Running or Threading Wire through Split Posts.

An easy and simple way to do this is to place the coil on a reel made on the capstan principle; this allows the wire to run off freely, and prevents it getting entangled, &c. The wire is then pulled through the holes from one strainer post to the next, and strained up tight. It can, however, be fastened anywhere between the posts with a patent strainer. This can also be made to work at a post, which is an improvement. Another way is to bore right through the strainer posts and pull up either with rollers or forks.

Strainer Posts are the mainstay of a wire fence, and should be of the best timber procurable, with a diameter of not less that 12 inches. Those



Reel for carrying and unwinding wire.

used at angles should be mortised to receive stays or struts. The strainers should be let into the ground at least 3 ft. 6 in., and be very thoroughly rammed. All posts should have the bark taken off before being put into the ground.

Stays or *struts* should be used at all corners, two for every angle, to be placed inside, clear of the split-posts, not less than 13 feet long, and 6 inches in diameter at small end, with a good strong stake driven into the ground about 15 inches deep at the end; the large end should be away from the strainer. One stay may be used, which divides the angle equally and projects into the paddock, but is awkward and somewhat dangerous at corners for large stock.

Where timber is plentiful, four stays may be used at a strainer post with advantage, two on each side of the wire, on opposite sides of the strainer, and mortised into it, close together, not more than a few inches apart, and secured as before mentioned. Do not have stays too short; they should be at least 13 feet long, and do not use a post in the fence instead of a stake for a support.

Strainer posts should not be more than 4 chains apart.

Drawn Iron Fencing Wire.

Wire gauge.	Weight of 1 mile. cwt.	qrs.	lbs.	Length of 1 cwt. yards.
4.	6	1	14	276
5.	5	1	7	332
6.	4	1	19	397
7.	3	2	20	479
8.	3	0	8	573
9.	2	2	10	680
10.	2	0	7	819
11.	1	2	18	1,050
12.	1	1	2	1,393

Posts to the Mile.

(Fractions neglected.)

ft.	in.		
8	3		640
9	0		5[illegible]7
10	0		528
11	0		480
12	0		440
13	0		409
14	0		377
15	0		352
16	6	(1 rod)	320

Hawkesbury Agricultural College and Experimental Farm.

Agricultural Education.

H. W. POTTS.

[A lecture delivered at the Royal Exchange, Sydney, 16th August, under the auspices of the University of Sydney.]

Germany.

THE small kingdom of Wurtemberg, of the German Empire, with a population of 2,000,000 living on an area of 7,531 square miles—area of New South Wales, 310,700 square miles, forty times the size of Wurtemberg—is probably the most complete example of the effect of agricultural education we possess. A contented, happy, and prosperous people is the verdict of all who visit this fertile country. Sixty-four per cent. of the land is arable, and 75 per cent. of this is in the hands of the well fed, housed, and clothed peasant proprietors, whose farms are of the average size of 14 acres. Cereal crops, tobacco, fodders, sugar-beet, chicory, grapes, fruits, and vegetables are grown in wonderful profusion. The rearing of live stock and dairying are conducted.

Land is easily acquired by thrifty workmen, for which they are indebted to liberal land laws and the excellence of the country roads, also the establishment of village banks from which money is secured on easy terms.

It is only fifty years since Wurtemberg had the reputation of being one of the poorest of the German Provinces. Agriculture failed to provide a means of subsistence, mainly owing to a bad system of financial aid and the ignorance of the peasants.

To two leading men is due the credit of raising the country to its present happy condition of affluence, prosperity, and contentment. A pauper is now unknown in the country.

A scheme of village credit banks to advance money to small landholders, to be returned in small weekly instalments, was designed and brought into practical operation by Dr. Raiffeisen.

Dr. Steinbeis visited the Great Exhibition in London in 1851, and there the idea occurred to him of formulating a scheme of technica education for the rural population of his native country. His book "Elements of Work Schools" formed the basis of a compulsory and universal teaching of agriculture.

The first of the winter schools was compulsorily brought into operation in 1879, at which every pupil attended a course of general and

agricultural education of at least two evenings per week for six months. There are now 700 schools, with an attendance of 16,000 pupils. There are over 100 voluntary evening schools, attended by 2,000 pupils over 18 years old. The village schoolmaster is trained at suitable centres in this course of teaching, and is assisted by itinerant specialists or experts in the technical details of agriculture.

From these elementary schools pupils who desire to follow agricultural education further pass on to the Farm Schools or Colleges. There are five of these schools with model farms attached; a course extends over three years. The pupils are sons of small landowners, farmers, and agricultural labourers. They receive board and instruction free of charge, giving their labour on the land for this privilege.

From these farm schools the student has the opportunity of entering what is generally recognised as the best agricultural college in Germany, and probably the most perfect institution of its kind in the world, the Agricultural University of Hohenheim, which has been established since 1818. It was promoted to the rank of a university in 1847. To it is attached a College of Forestry, a model farm, technological institute, sugar factory, distillery, brewery, vinegar factory, laboratory for testing garden and farm seeds, and a department for proving agricultural machinery, a butter and cheese factory and model dairy, poultry yards, live stock departments, fish-breeding ponds, and a bacteriological institute. A splendid museum is attached, in which is found a unique collection of agricultural products and implements, soils, and minerals.

The library contains 14,000 volumes, and an herbarium of some 30,000 plants. The physical, chemical, botanical, and biological laboratories are models for teaching purposes and equipment.

All agricultural implements and machines are submitted to rigid examination and tests in the presence of the farmers. New methods of culture, manuring, new varieties of plants and seeds, are tested by a competent and separate staff.

This splendid system of complete agricultural education, combined with the establishment of the co-operative banks first started by Raiffeison in Stuttgart in 1880, have doubtless provided the requisite stimulus and knowledge to effect such excellent results. There are over 700 of these co-operative banks in Wurtemberg—the usurer has disappeared.

The vote for agricultural education for the province exceeds £80,000 per annum.

A compulsory course of training in agriculture, gardening, and horticulture of two hours weekly is found in all the primary schools of the German Rhine Province during the final two years of the school curriculum. The teacher is given a free hand in determining the character and scope of the training in which the agricultural needs of the district are to be considered. The success of the tuition, it is fully recognised, largely depends on the theoretical and practical knowledge possessed by the teacher, his enthusiasm, and ability to teach.

France.

In France the Organic Law of 1850 placed "Elementary instruction in agriculture" as an optional subject for teaching in the curriculum. An agitation commenced in 1860 to make the teaching of agriculture in the primary schools obligatory; this terminated in 1879 by provision being made for departmental and communal instruction in agriculture by means of departmental centres, and further made primary instruction in the elements of agriculture an obligatory subject.

In the instructions issued to teachers under this law they are advised that—"they should commence by employing visible and tangible objects, which they should make the children see and feel, thus putting them face to face with concrete realities; then by degrees they can exercise them in obtaining from these objects abstract ideas, by comparison and generalisation, and by the use of the reasoning faculties without the aid of actual specimens."

The law of March, 1882, made compulsory teaching "the elements of physical and natural science with their application to agriculture."

In 1888 a further revision of the methods of teaching agriculture in the primary schools was declared essential. Finally the French Minister of Instruction issued the following guide to public school teachers on the 25th April, 1898, to direct them in this routine work of teaching elementary agriculture:—

"Instruction in the elementary principles of agriculture, such as can be properly included in the programme of primary schools, ought to be addressed less to the memory than to the intelligence of the children. It should be based on observation of the everyday facts of rural life, and on a system of simple experiments appropriate to the resources of the school, and calculated to bring out clearly the fundamental scientific principles underlying the most important agricultural operations. Above all, the pupils of a rural school should be taught the reasons for these operations, and the explanation of the phenomena which accompany them, but *not* the details of methods of execution, still less a résumé of maxims, definitions, or agricultural precepts. To know the essential conditions of the growth of cultivated plants, to understand the reasons for the work of ordinary cultivation, and for the rules of health for man and domestic animals—such are matters which should first be taught to everyone who is to live by tilling the soil; and this can be done only by the experimental method.

"The master whose teaching of agriculture consists only in making the pupils study and repeat an agricultural manual is on the wrong path, however well designed the manual may be. It is necessary to rely on very simple experiments, and especially on observation.

"As a matter of fact, it is only by putting before the children's eyes the phenomena to be observed that they can be taught to observe, and that the principles which underlie the science of modern agriculture can

be instilled into their minds. It should be remembered that this can be done for the rural agriculturists only at school, where it will never be necessary to teach him the details which his father knows better than the teacher, and which he will be certain to learn from his own practical experience.

"The work of the elementary school should be confined to preparing the child for an intelligent apprenticeship to the trade by which he is to live, to giving him a taste for his future occupation; with this in view, the teacher should never forget that the best way to make a workman like his work is to make him understand it.

"To sum up: The aim of elementary instruction in agriculture is to initiate the bulk of our country children into that degree of elementary knowledge which is necessary to enable them to read a modern book on agriculture with profit, or to derive advantage from attending an agricultural conference; to inspire them with a love of country life, so that they may prefer it to that of towns and factories; and to convince them of the fact that agriculture, besides being the most independent of all means of livelihood, is also more remunerative than many other occupations, to those who practise it with industry, intelligence, and enlightenment."

This entailed the provision for establishing school gardens and farms. At the present time nearly 4,000 primary schools in France have these farms. The training of teachers for rural districts includes agriculture.

The superior primary schools' curriculum embraces lessons on general facts of agricultural production, treatment of the soil, principles of irrigation and drainage, the management of agricultural labour and machines, the study of insects, as well as special instruction in horticulture, arboriculture, and viticulture, the treatment and health of domestic animals, their breeding and fattening, dairy work, farm book-keeping, rural economy, bee-keeping, silk-worm culture, and poultry raising. Only those plants, animals, and methods are treated in detail which form a distinctive feature of the agricultural industry of the district. Weekly visits are made to farms, dairies, piggeries, and such like in the district, by the pupils accompanied by the teacher. Medals and money are awarded annually by the Government, municipalities, and agricultural societies, to both masters and pupils who distinguish themselves at competitive examinations on the subjects relating to agriculture and its allied industries.

Italy.

The Director-General of Primary and Normal Instruction issued, under date 29th November, 1897, a report, in which is shown that in 471 elementary schools practical teaching in the rudiments of agriculture was given, but shortly afterwards a strong demand was made to attach a piece of land to each school so that the essential rules of the art of

cultivating the soil could be learned by observation and experiment. The appeal was couched in the following terms:—

"Let us return to the fields! This is the invitation which from all time men of superior understanding and of generous hearts have repeated to the Italians. Be it granted to us to join them; let us enamour the rising generation with the land! From the little garden, where the country teacher shall practically teach the rudiments of agriculture, upwards through the technical schools and the professional institutes, may the knowledge of agriculture continually be reinforced and elevated; everywhere may there re-awaken the Virgilian affection for rustic labour."

In less than six months, 2,257 blocks of land, varying in extent from a small garden to that of a farm, were presented for the purpose. Courses of instruction were arranged for teachers at the Royal School of Practical Agriculture of Ascoli Picera, and certificates were issued to those who attended. Other similar institutions were utilised, where teachers acquired a sufficient knowledge and training of the principles and practice of elementary agriculture. Lectures were given at 184 places, with a total attendance of 8,000 teachers. In 1899 12,000 teachers had obtained the certificate of attendance.

Great care has been exercised to see that teachers know how to adapt their treatment of the subject to the age, intelligence of the pupils, and to local needs of the district; and also that the teacher possesses the aptitude, experience, and education necessary for his work.

The Department declined to adopt a general text book for pupils, on the grounds that it depended solely on the efforts of the teacher, for whom it was more essential to be provided with a text-book.

During the year 1898-9, 8,000 rural schools were given instruction on the subject.

Austria-Hungary.

To each elementary rural school a fruit garden is given. Special attention is devoted to the theoretical and practical teaching of agriculture. In the National Schools, instruction in agriculture is combined with natural history. The tuition embraces the description of domestic animals, vegetables, and minerals; the cultivation of vegetables and fruits, the breeding and rearing of cattle, agricultural methods, and, where local conditions are suitable, silk-worm rearing.

Hungary.

Hungary boasted of an agricultural college in the eighteenth century and may claim priority amongst the countries of the world in providing systematic agricultural education for her people.

Lectures on agriculture were first given at the University at Nagy Syombat in 1680. The first farm school was established at Syarvas. A Chair of Agriculture was established at the University of Sciences at Buda in 1777. Agricultural schools and colleges were established and endowed by several noblemen. There are now four agricultural colleges

with courses ranging from two to five years. Winter farm schools are maintained by the Government, at which 300,000 students attend.

Agricultural education now comprises:—

Higher teaching in the Agricultural Academy, with a yearly attendance of 157 pupils.

Intermediate education, provided by four agricultural colleges, at which there is a yearly attendance of 502 students.

Practical teaching and training in farm schools.

Itinerant teaching, conducted by seven departmental professors, who travel from place to place teaching, and four experts for the cultivation of hops, hemp, dairying, and promotion of rural associations.

Twelve professors are engaged in training teachers for the rural schools.

The staff of the Department of Agriculture numbers 185 professors, teachers, experts, &c.

Switzerland.

In Switzerland there are sixteen agricultural schools with about 400 students, who pay in fees £16 per annum each. The expenditure devoted to agricultural education has risen from £49,000 in 1888, to nearly £200,000. This is given towards the support of agricultural schools, aid to farmers, improvement of stock, prizes, &c.

Denmark.

The extraordinary agricultural development of Denmark is attributed to the intelligence and capacity for organisation of the Danish farmers, and mainly to the education received by the peasantry in their rural high schools, and to the distribution of land amongst freeholders. There are 224,000 farms in Denmark, ranging from 7 to 110 acres each, of which more than 94 per cent. are farmed by their owners.

Sir John Gorst, in referring to the progress of technical education in Great Britain, recently made the following remarks as to Denmark:—"The important influence technical education had on the national, social, and economical development of the people was indicated in the case of Denmark, which had, from being the poorest of European countries become one of the richest, and that by producing butter, bacon, and eggs chiefly for the English market."

Sweden.

The practical teaching of agriculture with arboriculture has been in vogue for a very long period. Since 1865 the teachers of the National schools have been trained in these subjects. The regulations of 1882 states:—

"To every National School shall be annexed, so far as possible, a tract of ground to serve as an experimental kitchen garden, and it is the duty of the school council of every parish to see that such kitchen garden is arranged in a manner suitable to the object of instructing the children in agricultural subjects."

Belgium.

In Belgium the introduction of teaching agriculture in the rural primary schools dates from 1884. Article 49 of the regulations states :—

"The master must keep the garden belonging to the school in such a way that it may serve for practical instruction in the rudiments of agriculture, horticulture, and arboriculture. He must endeavour to make it into a model kitchen garden, containing the best varieties of vegetable and fruit trees."

Practical lessons both in class and in the gardens—on flowers, herbs, fruit trees, useful farm birds, and the common agricultural implements—are given at regular periods.

The expenditure of the Department of Agriculture exceeds £100,000 per annum.

England.

England has not been prominent in forwarding agricultural education with anything like the organisation and energy displayed by other countries in the past; of late, however, a marked change has swept throughout the rural counties. In 1887 the English Government set aside £5,000 to be distributed among agricultural and dairying schools.

The Board of Agriculture distributes grants to Universities, Collegiate, and other institutions engaged in teaching agriculture and allied subjects. It inspects educational and experimental work. It conducts experiments. It publishes a monthly Journal, and leaflets to farmers.

The County Councils are awakening to the importance of this work. and now some twenty-six institutions are engaged in teaching agriculture, and something like £100,000 is expended annually in England on agricultural education and research work. No effort has been made yet to organise systems such as exist in Wurtemberg, France, Denmark, Belgium, Austria, Italy, United States, and Canada.

A Chair of Agriculture was founded in 1790 at the University of Edinburgh, but Scotland has always been to the fore both in education and agriculture. The Chair of Rural Economy, established at Oxford by Sibthorp in the eigtheenth century, has not been noted for its agricultural activity. The Royal Agricultural College at Cirencester was established by private enterprise in 1845, and others followed.

The most noted of all efforts to establish agriculture on a scientific basis was the world-renowned experiment station at Rothamsted, established by Sir John Lawes.

In 1899 a Chair of Agriculture was established at Cambridge, and a well-organised Department of Agriculture. The subject is also taught at the Universities of North Wales and Durham.

Ireland.

The Commissioners of National Education in Ireland make a special feature of their efforts to teach agriculture in all rural National schools. Numbers of these schools have school farms, gardens, and live stock.

Rural teachers go into training in practical agriculture in residence at the Albert Institution, Glasnevin, near Dublin, for six weeks, where they qualify for certificates to earn special fees for practical agricultural instruction to pupils. Teachers are not only given this training free, but are allowed travelling expenses to and from the Institute from any part of Ireland. No teacher is permitted to give tuition in agriculture unless he has been trained and possesses a certificate of competency.

Two agricultural colleges are maintained, one at Glasnevin, Dublin, and one at Cork, where a sound system of agricultural training is provided. Itinerant dairy instruction is organised throughout the dairying centres.

Canada.

Despite the rigorous climate, this Colony may be considered one of the most advanced in so far as agriculture is concerned. No finer example can be instanced to-day of the beneficial results of well-considered State action in the enlargement of a national industry. Twenty years ago agriculture in the Dominion was very much depressed. To-day the output of wheat, dairy, and other natural products is marvellous. It is admitted by all the farmers that this is mainly due to timely and wise Governmental action.

In 1885 Dr. Wm. Saunders was commissioned to visit the agricultural colleges of the United States and Europe, and obtain preliminary information for the Government. An Act of Parliament, based on Dr. Saunders' report, was passed for the establishment of experimental farms and the proper control of agricultural education and efficient organisation.

The Act has been liberally interpreted, and administered with judicious enterprise. Example and precept are utilised to create responsive vigour in the farmers, the chief aim being to induce them to abandon the old practice of wasteful farming by robbing the land of its fertility without returning an adequate equivalent. This is scientifically demonstrated. The results obtained from deep ploughing, clean land, rotation of crops, good seed, and an economic system of manuring, are all clearly brought home to the farmer's mind. Each experimental farm devotes itself to work out the problems of agriculture for that particular district. From this centre a proper distribution of acclimatised seeds and plants is made to the surrounding farmers. More than 100,000 farmers have received free during the past ten years 3 lb. sample bags of seeds. Twelve thousand packages of seedling trees, shrubs, and plants, and more than 6 tons of seeds of hardy trees, have been sent out free.

Agriculture is taught in the State rural schools, and proper training provided for the teachers. A text-book is published. An examination must be passed by the scholar in agriculture before admission is permitted to the High Schools.

The Agricultural College at Guelph, Ontario, presided over by Dr. Mills and a highly-trained staff of educational experts, provides training

leading from short courses of six months, up to the term needed to qualify for the Bachelor of Science in Agriculture Degree of four years.

In addition special effort is made to organise Farmers' Institutes, for both men and women, Live Stock Associations, and Dairying Associations, all of which are highly educational. At their annual conferences, papers are read, and instructive discussions follow. These are published in pamphlet form and distributed.

Dr. Saunders states: "*The occupation of farming has been elevated in the eyes of the community.* It is no longer looked upon as a sort of drudgery suited to the dull and slow-going, but is now regarded as a suitable field for the higher intelligence of cultivated minds. It is recognised as a calling requiring much skill to conduct it successfully, and as giving ample scope for the exercise of the most active and earnest minds, and one in which information of almost every sort may be turned to practical account."

United States.

In 1894 the Secretary of the Board of Agriculture (Major Craigie) after investigating the working of the Morrill and Hatch Acts in the States by direction of the British Government, states:—

"The American Government seems willing to face any cost to the community that promises the better to equip the farmer with the knowledge of his business. The authorities seem assured that in indicating methods of profitable production, and still more by the careful perfecting of the produce of the vast lands of the Republic in whatever direction of extensive or intensive culture the economic circumstances of the moment may prescribe, they are providing a solid means of advancing the well-being of the nation as a whole."

The Morrill Act of 1862 laid the foundations of superstructures, and created an organisation for the furtherance of agriculture, the value and extent of which are unequalled in any other country. In that year Congress alienated 10,000,000 acres of land to provide funds to establish, endow, and maintain agricultural colleges and experimental farms in every State of the Union. This created an activity and interest in agricultural education and research which developed with extraordinary celerity. In 1885 a convention was held by those associated with agriculture, when the following resolution was passed:—

> "That the condition and progress of American agriculture require national aid for investigation and experimentation in the several States and Territories."

The Hatch Act of 1887 was formulated and became law—

> "In order to aid in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture, and to promote scientific investigation and experiment respecting the principles and applications of agricultural science."

In order to render this effective and defray expenses, a sum of £6,000 per annum was voted to each State. In addition large sums are annually voted by the State Legislatures, and these are augmented by private benefactions. With these funds so amply provided, thousands of experiments have been and are being conducted in every branch of farm work, as well as in rearing live stock, particularly in regard to co-operative tests. The results of these are distributed to the farming community in the most complete way, and entail a lavish expenditure for printing.

Dr. True, Director of Experiment Stations, states all this has been accomplished with splendid results, and he reports " a remarkable awakening of our farmers to the desirability of having more definite information regarding all matters connected with their business. The result has been that the stations and this Department have been led to publish a vast amount of information, both old and new, which has been freely distributed to farmers in every State of the Union. Nothing like it has ever been seen before. No country has ever attempted so systematic and so thorough a distribution of information to its agricultural population, and no masses of farmers have ever so eagerly sought for information as have our own within the past few years. Such an intellectual awakening must have most important results, and there is every indication that it will go on increasing in volume and force until it has thoroughly permeated the entire agricultural population."

He points out the special features responsible for their success as follows :—

1. The wisest leadership, by well-trained men.
2. Scientific investigations in agriculture systematically conducted.
3. The thorough organisation of the agencies for distributing information among the farmers.
4. Energetic teaching in the agricultural colleges.

He does not hesitate to caution his countrymen against permitting political influence to interfere with the management of the colleges and stations. Experience in this direction has been of a most objectionable character in the past.

Mr. Wilson, the U.S. Secretary for Agriculture, thus sums up the work of his Department :—

" The Department, through its bureaux, divisions, and offices, is getting into more immediate contact with all classes of producers throughout the country. . . . Especial attention is being given to the reclamation of soils that have been reduced in fertility by injudicious management. Production from the soil in all parts of the United States is being diversified by importations from foreign countries. The scientist and the cultivator are working together for greater national prosperity through more economic production. . . . The especial attention of the Department in the future will be given to the production, under United States jurisdiction, of products of the soil that now come from foreign

countries, keeping steadily in view the object for which the Department was organised—the help of the producer who is struggling with Nature."

The fundamental basis of national education in the primary education of America is Nature Study. A leading writer states—"It designates the movement originating in the common schools to open the pupil's mind by direct observation to a knowledge and love of the common things in the child's environment." In the successful adoption of this method the personality of the teacher is pre-eminent; there must be enthusiasm. The aim is the development of mental, reasoning, and observant powers of the child. It enlivens the means of teaching to both tutor and pupil. The study of plants and animals can be associated with the earliest lessons in the common school. The readiness with which children improved under this method has resulted in its universal adoption in the States.

Recently an organised movement has been made to introduce the elements of agriculture into the rural schools, preceded by the establishment of school gardens. These were the outcome of the nature study education, and developed a trend towards agricultural training. The American League of Industrial Education, the National Educational Association, and the American Civic Association have all included in their propaganda the promotion of school gardens and farms, and the teaching of agriculture in the common schools.

The Dean of the College of Agriculture in Illinois gives the following reasons for teaching agriculture in these schools :—

1. To cultivate an interest in and instil a love and respect for land and the occupation of agriculture.
2. To create a regard for industry in general and an appreciation of the material side of the affairs of a highly civilised people.
3. To cultivate the active and creative instincts as distinct from the reflective and receptive that are otherwise almost exclusively exercised in our schools.
4. To give practice in failure and success, thus putting to the test early in life the ability to do a definite thing.
5. To train the student in ways and methods of acquiring information for himself and incidentally to acquaint him with the manner in which information is originally acquired and the world's stock of knowledge has been accumulated.
6. To connect the school with real life and make the value and need of schooling the more apparent.
7. As an avenue of communication between the pupil and the teacher, it being a field in which the pupil will likely have a larger bulk of information than the teacher, but in which the training of the teacher can help to more exact knowledge.

Several States have made provision for training the teachers in agriculture, and make it a compulsory subject in their examinations. At Cornell University a two-years' normal course is provided in nature study and gardening. Ten normal training-schools have been opened in Michigan for the express purpose of training teachers for rural schools.

Text-books have been published suitable for the various States.

In North Carolina State 12,000 children received instruction in agriculture last year.

In addition to the education in the rural schools, the provision made in the splendidly staffed and equipped agricultural colleges in every State, in proportion to its population, is not rivalled in any part of the world. The courses are arranged to meet the requirements of all classes of agriculturists, and extending from periods of twelve weeks to five years. The longer period course in most instances entitles the student to present himself for the Bachelor of Agricultural Science Degree, which is granted at all the American Universities.

The training in the high schools is essentially such as to mentally and physically equip a lad for the specific education in an agricultural college. The subjects of manual training, physiography, elementary chemistry, physics, geology, algebra, mathematics, and geometry are taught.

Popular Education of the Farmer.

For those farmers and their sons who are unable to attend the agricultural colleges of the various States, several schemes have been evolved. Short courses have been offered, and farmers' clubs organised on the University Extension plan. Under the auspices of the agricultural colleges and kindred establishments, such as the experiment stations and agricultural associations, farmers' institutes are now very popular, at which lectures and demonstrations are provided by the State experts, and often by those sent by the central authority at Washington. Michigan set the example in 1892. The railway companies realise how important it is to their revenue to have a well-educated class of farmer on the land through which their lines run, and offer the greatest facilities to farmers to attend courses of instruction. In fact, they supply special trains free to bodies of farmers of sufficient number to convey them to the agricultural colleges on special occasions to inspect the crops and methods pursued at these and the experiment stations where lectures are given by the officers.

One of the most recent methods adopted to reach the farmer is for the State to fit out two railway cars, one as a store for roots and seeds and as an agricultural museum or exhibit, the other suitably seated to act as a lecture room and sleeping apartment. Expert itinerant lecturers are engaged, and are conveyed through the rural districts free. A systematic course of lectures is thus given at every station where these cars are left, to the farmers in the district, either during the day or in the evening, whichever is found most suitable to the local residents.

Instruction is given, the exhibits are fully explained, seeds and roots are distributed free, and the railway companies are recompensed for their enterprise by the increased production and carriage on their lines, as a result of this advanced technical education.

This brief and necessarily incomplete *précis* of educational effort as it is conducted in the advanced countries of the world evidences the great attention now being devoted to it, and the stimulus thus provided for increasing the value of the primary industries.

One of the great factors towards this end is the experiment station or farm. A recent publication issued by the States Department of Agriculture by Messrs. True and Crooby, gives a brief account of 720 experiment stations and similar institutions throughout the world, embracing all civilised countries, the largest number of separate agencies being in Russia. There are 102 experimental stations and 3 experimental forests, the bulk of which are for the purpose of introducing new agricultural industries and teaching the peasants.

Germany	possesses	80	Australia	possesses	34
France	,,	71	Netherlands	,,	7
Austria	,,	41	Sweden	,,	26
Great Britain	,,	30	Norway	,,	12
India	,,	11	Japan	,,	15
Belgium	,,	15	Switzerland	,,	10
Hungary	,,	20	Canada	,,	12
Italy	,,	22	United States	,,	58

It will be seen that an attempt has been made in this lecture to demonstrate the necessity for preparing the child for rural occupations.

The primary system of education hitherto conducted has been more adapted to the requirements of urban than of rural children. Many who attend rural schools are unable to attend continuation or high schools.

It would further enhance the training of a child for country life by receiving its earliest training in Kindergarten. Children of both sexes are rendered more fitted for any occupation where manual effort and a trained eye are essential to success. To direct the child's mental and physical development to useful purpose, and in keeping with its surroundings, is the commendable aim of the new education. The education for a child intended for rural life should commence in the primary school from the first impulse to use the fingers in Kindergarten, to the unfolding of natural processes by nature study; the school garden, the study of flowers, fruits, vegetables, birds, insect life, the domestic animals, and manual training.

Sir Phillip Magnus, one of the highest authorities upon educational work, writes :—

"People often talk and write as if school time should be utilised for teaching those things which a child is not likely to care to learn in after life, whereas the real aim of school education should be to create a desire

to continue in after life the pursuit of the knowledge and skill acquired in school. In other words, the school should be made, as far as possible, a preparation for the whole work of life, and should, naturally, lead up to it. The endeavour of all educators should be to establish such a relation between school instruction and the occupations of life as to prevent a break of continuity in passing from one to the other. The methods by which we gain information and experience in the busy world should be identical with those adopted in schools. It is because the opposite theory has so long prevailed that our school training has proved so inadequate a preparation for the real work of life. The demand for technical instruction, both in our elementary and in our secondary schools, is a protest against the contrast which has so long existed between the subjects and methods of school teaching and the practical work of everyday life."

Any system of education tending to direct children's attention from rural industries in country districts is to be regretted.

In the new Syllabus issued by our Education Department, correlation, self activity, and reality are prominent, and the schemes for nature study and the rudiments of agricultural and elementary science are set out in such form as will tend to provide one of the missing links to the higher agricultural education:

This training will illustrate the phenomena of nature, train and expand the child's power of observation, excite an impulse to work, reveals attractive features in what has hitherto been considered menial work, and unfolds elevating influences in the child's surroundings.

This, however, opens up the question of training for our teachers. This may be regarded as the bed-rock of success in this connection. All the enthusiasm and earnestness of a teacher may be thrown away in the absence of a competent knowledge of the subject.

We have in our Agricultural College all the equipment for conducting the work, with the exception of the teaching staff.

Already a start has been made at the Hawkesbury Agricultural College, where 5 acres have been set apart for conversion into an orchard, flower, and vegetable garden, and experimental plots.

Another missing link is the education in the secondary schools tending towards the preparation of the student to rural life, and an entrance to the Agricultural College; in fact, complete the co-ordination of the different branches of primary, secondary, and technical education.

Many leaders of education in new countries such as ours will agree with Professor Ray Lankester, when he declared in the course of his Romanes lecture, delivered in the Sheldonian Theatre, Oxford, in June last, "That he wished to see the classical and historical schemes of education entirely abandoned, and its place taken by a scheme of education in the knowledge of nature." He urged the study of physics, chemistry, geology, and biology.

Our secondary schools might, with advantage, teach elementary agriculture, zoology, physiography, or physical geography, elementary physics, chemistry, botany, geology, mathematics, manual training, book-keeping, and physical exercise.

The Agricultural College is becoming more popular every year ; greater provision will require to be made to meet the demand for further accommodation. The effectiveness of the tuition will be vastly increased by students who have gone through the training outlined in the primary and secondary schools. The usefulness of the College and Experiment Farms might be extended in such a way as to assist the elementary schools in training the teachers, and in supplying seeds, roots, trees, plants, &c., for the school gardens.

The University should prove the ultimate aim of those students whose attainments warrant them going to the higher training of a degree in Agricultural Science. New Zealand and Victoria grant such degrees, why not the Sydney University ? One of the most urgent demands of our agricultural system is competent and trained men as teachers. This will become more emphasised, and to complete the chain of our work, the degree is essential.

I would, in conclusion, also urge a system of teaching to reach the farmer. Natural difficulties present themselves in our large areas, where the agriculturist is difficult to reach, but such are not unsurmountable. Farmers' institutes, reading courses for farmers, educational conferences, have been made a success in Canada and the United States by means of peripatetic lecturers. Our agricultural societies can be utilised as a basis to extend their work from that of organising an annual show, to technical education. One form especially commends itself to those whose life work in the country is associated with live stock, *i.e.*, " First aids to sick and injured farm animals." Immense losses are annually made through ignorance in the treatment of live stock.

I cannot close the subject without paying a tribute of praise to the New South Wales Parliament and the Department of Agriculture for the splendid organisation in the founding and conduct of essential aids to our producers. The *Agricultural Gazette*, the College, Experimental Farms, the Staff of trained Experts, the Scientific Staff, have built up, and are engaged in designing a system of agriculture suitable to our conditions, and of incalculable value to the country.

The lecture was illustrated by a large series of coloured illustrations, exhibited as lime-light views, of representative colleges, experimental farms, farm schools, gardens, &c., throughout the world.

Ducks and Duck Farming.

[Continued from page 916.]

D. S. THOMPSON,
Poultry Expert, Hawkesbury Agricultural College.

IV.

OTHER BREEDS.

The Aylesbury, Pekin, Rouen, Indian Runner, and Buff Orpington—these five breeds—may be looked upon for the present as our standard varieties of ducks, and this small list includes the whole of the duck family as bred to-day in domestication.

This chapter on "Other Breeds" will include a short list of ducks more or less bred in Australia or in other countries, but, at the present time, they are in the hands of a very few people, and there is no sign of them becoming popular at any early date.

These articles would be incomplete without some reference to the other at present little-known breeds, and, as many of them are of excellent merit, we are not going to be rash and predict that they will never be more popular than they are to-day. In fact, we are rather inclined to think that several of the breeds we intend to give a short description of, will, at an early date, become popular and far more largely bred than they are to-day. The nomenclature of the duck family in our exhibitions is a very limited one, and can easily be extended to at least double its size, and there is room for the development of a few new varieties. The old-timers, the Pekins, the Aylesbury, and the Rouen, will still go on; but the new varieties, the Indian Runner and the Buff Orpington, will far surpass them in popularity for a number of years to come, and it is possible that they will be followed by some new variety, or, perhaps, by the perfecting of some of the breeds already in existence, but which have, at least up till now, made little or no headway in the good graces of the general duck-breeder.

The Blue Orpington.

The Blue Orpington is one of the newly-created breeds, but it has made little progress, nor is it showing any signs of making much progress in the near future. The Blue Orpington and the Buff Orpington were imported at the same time, and while the writer we quoted, as reviewing the importations of the late W. Cook in 1900, said, "The Blue Orpington is a good-sized, square-bodied bird, of a blue-slate colour, and may well win a place in popular favour; but the Buffs are interesting, mainly, if not solely, because they are novelties"—yet we have found it just the reverse; the Blue Orpington has not yet found any popular favour, while the Buffs are now on the jump to become a very popular duck, and, in a few years' time, will be bred in thousands all over the continent. We have seen many specimens of blue ducks, but never perpetuated or bred for colour.

Lewis Wright also speaks of blue ducks, and of their being well known and largely bred in Lancashire, but he speaks of them somewhat disparagingly, and as of being very difficult to breed true to colour. However, that is a very common difficulty in many kinds of fowls, and a difficulty which can be overcome.

Blue Orpington Duck.

Mr. E. Butcher, of North Sydney, who was acting as agent for W. Cook and Sons, of Orpington House, England, was the first to import Blue Orpington ducks, in 1899. The second importer was Mr. S. Ellis, of Botany. Mr. Ellis has still the progeny of the Blue Orpingtons, but we believe Mr. Butcher has gone out of them through finding them very hard to breed to colour.

Of the most prominent breeders of the Blue Orpington duck at present in Australia, we find, besides Mr. S. Ellis, of Botany, that Mr. G. W. N. Brunker, of East Maitland, is a large breeder of the variety, and he has found them a very useful duck, but he also complains of the difficulty of breeding them true to colour.

No doubt, before long, this duck will also take a jump in popularity, and follow in the wake of the Buff Orpington. Of the two colours, buff is the more natural, and is, consequently, the easier bred. Both colours are undoubtedly produced from the one foundation, although travelling different ways, the ground colour of the original Rouen being fawn, which is far more easily retained than the blue or slate.

Our duck family is so small that there is plenty of room for the admission of the Blue Orpington, and if breeders persevere they will no doubt get over the difficulty of colour breeding.

As with the Buff Orpington, with an apology, we offer the following standard.

Blue Orpington Ducks.

General characteristics of either sex :—

Head and neck.—Head, massive and broad, with prominent skull. Beak, long, wide, and flat, very strong, and somewhat straight. Eye, bold and bright, and deeply set in the head. Neck, long, medium thickness, not so thick as the Pekin and not so fine as the Indian Runner.

Body.—As wide and long as possible, broad in front and wide across the back, deep in keel, and carrying plenty of breast meat; not too heavy behind. Wings, strong, well feathered and closely carried, not too long.

Tail.—Short, but well feathered, plain in the duck, and curl feather in the drake.

Legs and feet.—Strong, medium length, showing more than in the Rouen, well set, a nice balance, and showing activity.

General shape and carriage.—Not so heavy in pouch as the Rouen, fairly long in body, with large frame, a good keel but not so deep as the Aylesbury, and more active.

Colour in Blue Orpington Ducks :—

Head.—Very dark slate right down the neck, with no white ring as in the Rouen.

Body.—A slatey blue all over as even as possible, wing bar allowed, but must be of the same colour as the body, only it might be permitted to be a darker slate. The breast, however, must be as even slate as possible, and not claret as in the Rouen; the duck ought to be as even all over in slate as possible, including the head, and the neck should be slate right down to the body without any intervention of white, as in the Indian Runner.

Bill.—Bean drab, with a black bean on tip.

Legs and feet.—Rich orange.

Size and weight.—Ducks, 8 to 9 lb., drakes, 9 to 10 lb.

Value of points in judging :—

Defects.	Deduct up to Points.
Defects in head and bill ...	10
" tail ...	5
" neck ...	5
" colour ...	20
Want of symmetry ...	20
" size ...	20
" condition ...	20
	100

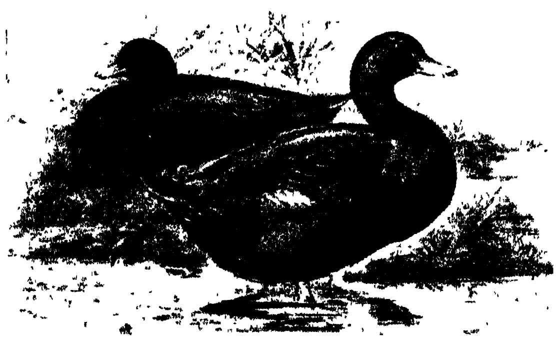
Serious defects for which birds should be passed :—

Crooked back, crooked breasts, wry tail or any other deformity, including slipped wings, claret breast in the drake, or much white in the neck of either sex.

Cayuga Ducks.

The Cayuga is an all-black duck and are very rare in Australia, so much so that we do not know of a single specimen of the breed in the whole continent, nor can we find any advertisement of them in any paper in Australasia. Mr. E. White, of Belltrees, imported some of these ducks from America in 1898, and in 1900 there was a pen of them at the College. They are very well known in America, but not much bred. They are comparatively unknown in England.

They are an American production, and with their black feathering they have never caught on in England. The name Cayuga is given to them by the Americans from Cayuga Lake in Central New York State, where they were first bred. Like all other breeds of poultry, their origin can only be conjectured. Some Americans say they have been bred up from the American wild black duck, while others



Cayuga Ducks. (After Ludlow.)

say that they have been bred from the Rouen by intercrossing of the Black East Indian. They are a very hardy duck, very quick maturing, but are no improvement on the Pekin, which will always be preferred before the Black Cayuga on account of the colour of the down and feather, the black down being objectionable on table ducks. One fault against them is that they often become magpie after moulting out, and do not always breed consistent blacks. They have been bred for many years in America, long before the Indian Runner was known in England, so that, next to the Aylesbury and Rouen, the Cayuga is one of our oldest domesticated breeds of ducks.

Ducks similar to the Cayuga have been known in England for years, but they have generally been of a less lustrous colour, and a good deal splashed with white.

The original Cayugas were imported into England from America in 1871 by the late Mr. J. K. Fowler, of the Vale of Aylesbury. They have been exhibited at English shows for a number of years, but have never been taken seriously for market production. By some market producers in America the claim is made that they can be produced even more cheaply than the greatest of market ducks in America—the Imperial Pekin. But even in America, where the epicures are not as great faddists as their English cousins, they object to the black

feathering, and many people in America say that otherwise they would be very popular and largely bred.

Cayugas are splendid birds for a restricted range and for breeding in suburban yards, where their black colour is a recommendation, in that they do not show the dirt of the city or suburban allotment. They are quiet, docile, and form a strong attachment to their home, evincing no desire to stray. The ducklings are hardy, easily reared, easily fattened, and attain a good size at an early age. The head of the Cayuga is small, the bill rather short and broad, of dark colour, black preferred. The plumage is a brilliant, glossy black throughout. The standard of the poultry clubs of England and of New South Wales is as follows :—

Cayuga Ducks.

Head and Neck.—Head, large. Beak, long, wide, and flat, well set in a straight line with the eye. Eye, full and prominent. Neck, long and tapering, and gracefully curved.

Body.—Long, broad, and deep. Back, broad and long. Breast, prominent. Keel-bone, deep and heavily fleshed, well rounded under-line.

Tail.—Carried well out and closely folded, with two or three curled feathers in that of the drake.

Legs and Feet.—Large and strong in bone, well set, so as to balance the body in a straight line.

Toes.—Straight, connected by the web.

General Shape and Carriage.—Similar in carriage to the Rouen, of a lively appearance.

Size and Weight.—Ducks, 6 lb. ; drakes, 7 lb.

Plumage.—Bright and glossy.

Colour in Cayuga Ducks :—

In Both Sexes.—Beak, slaty black, with jet-black saddle down centre, coming within one inch of the tip, but not touching the sides. The bean black. Eye, black.

Legs and Feet.—Dull orange-brown.

Plumage.—A deep black with a bright and lustrous sheen of green all over, though naturally more lustrous on the wings than elsewhere.

Value of Points in judging Cayuga Ducks.

Defects	Deduct up to. Points.
Defects in head and bill	10
,, tail	5
,, neck	5
,, legs and feet	8
,, colour	20
Want of symmetry	25
,, size	15
,, condition	12
A perfect bird to count	100

Serious defects for which a bird should be passed :—

Crooked back, wry tail, or any deformity ; orange or dished bill.

The foregoing breeds, viz., the Aylesbury, the Pekin, the Rouen, the Indian Runner, the Buff Orpington, the Blue Orpington, and the Cayuga Ducks, along with the Muscovys, are practically all the varieties that are more or less bred to-day in English-speaking countries for pleasure and for profit.

To make this work as complete as possible, however, a short outline of a few breeds, which can without fear be classed as purely ornamental, and are bred only for pleasure and ornamentation, is included. The most important of these are the

Black East Indian Ducks.

These ducks are very small and are quite useless for profitable poultry breeding compared with the best market ducks. They are hardy and easy, to breed, are very pretty, and make splendid ornaments for small lakes in enclosed grounds. They are very tame, and will breed in the rushes alongside of any pond or artificial lake. They seldom grow larger than 2 lb. weight. They lay very few eggs, which are very small compared with the ordinary breeds of market ducks. The colour of the egg is also somewhat different to other breeds of ducks, being nearly black. These ducks have never been thoroughly domesticated, and although tame in lakes and ponds they will often migrate if given the opportunity to do so. They are supposed to have been first found in South America in the vicinity of Buenos Ayres.

The Black East Indian in shape and habit closely resembles the English Wild Duck (*Anas boschas*), and they will breed freely with them and again *inter se*. They breed largely if left to themselves on large lakes, and make delicious eating when used to the wing, the excellent fineness and flavour of the flesh being exquisite.

The head of the Black East Indian Duck is short and small. Eyes dark hazel, bill rather short. The head of the drake is of a dark yellowish-green, free from all spots or blemishes, and the duck's head is very dark, almost black. The exact colouring of the bill of the drake is considered of the utmost importance. It is described by an enthusiast as being a sort of pale yellow washed over with green. The neck is neatly curved and short, the body plump but small, and the wings powerful. The plumage is a brilliant green sheen throughout, and the smaller the duck the more brilliant the sheen. The ducklings when first hatched are very black in fluff, with a yellow shade on the breast. The legs and feet are jet black.

They are mostly bred for ornament, and are shown for pleasure in England, but are not at all likely to be much bred or exhibited here.

Other ornamental ducks are the Mandarin duck, which is a wild duck of China, but which are also bred by the Chinese in domestication under the name of Li-chi-ki. They are very small and purely ornamental so far as breeding for profit is concerned.

Another ornamental duck is the Carolina, which is an American duck and is crested; it is very small, about the same size as the Chinese Mandarin duck. Then we have the Teals, the Shieldrakes the Pintails, and the Whistling duck, most of which are found in Europe, and the British Isles.

Wild ducks are found in Australia. They are generally called Wild Black Ducks, but they are not black although they are of a very dark colour. In dry seasons they are seldom much seen, but if the

autumn months are wet with plenty of rain to fill the creeks and lagoons, they are met with in large numbers.

The ground colour of the plumage is a dark brown, somewhat resembling the Wild Mallard of Europe. We have also the Wood Duck of Australia, which is also called the Manel Goose from the mane on the neck of feathers of different colour to the ordinary neck feathers. The general body colour is somewhat of a dirty grey, with a brown head and neck, with white spots, and the under parts are mostly of a dirty white. They are very nice eating, but are not met with in such plenty as they were years ago on this continent. The featherings of wild ducks are very pretty, and make splendid subjects for the artist.

We have given a full delineation of all the domestic ducks bred for profit, and a short account of the ornamental. Our next chapter will be the first on the practical side of the question of duck farming.

(*To be continued.*)

PLAGUE LOCUSTS—EXPERIMENTS AT MERRIWA.

THE Government Entomologist (Mr. W. W. Froggatt), with the assistance of Mr. Cooper, of Merriwa, carried out some experiments with plague locusts in October last on large but isolated swarms of young hoppers.

The first experiments were made with Criddle's compound, a mixture of dry horse-droppings, Paris green, and salt, made up with water and scattered with a shovel from the cart among the swarms. This was very successful, and within two days it was found that it had been devoured by the young hoppers, and immense numbers were lying about among the thistles dead, though there was abundance of green grass all over the country. Mr. Cooper afterwards, at Mr. Froggatt's suggestion, procured a spray pump and sprayed the patches of feeding hoppers with strong kerosene emulsion, and wrote that he was confident that if they were taken in time—that is, as soon as the baby hoppers commenced swarming—they could be very easily cleared off by either method at a very slight cost. Mr. Froggatt further states that he is of opinion that with a cart and a spray pump in such places as Condobolin and other western towns where the grasshoppers or locusts lay their eggs, it would be very easy to kill the bulk of them off in the early stage before they had done any serious damage, without waiting for them to eat poisoned food or become infected with fungus germs. Mr. Froggatt would be very glad this season to have the assistance of persons favourably situated for such experiments.

Seeds and Seed Testing.

(For Farmers.)

C. T. MUSSON,
Hawkesbury Agricultural College.

Part I.

CONTENTS.

ACKNOWLEDGMENT.

The writer has to acknowledge having made use of numerous publications in the preparation of this paper.

INTRODUCTION.

The necessity for using good seed was never more pronounced than at the present time.

The farmer should take the following matters into consideration with respect to seed when arranging for seeding operations :—

1. Suitability for district—as to kind and variety.
2. Freedom from, and resistance to, disease.
3. Quality.
4. Purity.
5. Capacity for germination.

Probably numbers 1 and 3 are attended to by the majority of growers, but it is almost certain that to numbers 2, 4, and 5 but little attention is given.

It is proposed herein to deal with this subject from various points of view, and finally give details as to how seed may be tested at home.

Whilst the modern farmer finds no difficulty in obtaining good seed, and seedsmen do their utmost to supply the very best article, we have seen during the last few years samples of various seeds purchased for seeding purposes that were bad and even useless, or containing weed seed impurities in much greater proportion than should have been the case. There is a growing interest in the testing of seed in this country, but it is not by any means so keen as it should be.

The farmer of all men should be intensely keen in this matter, as good seed is so essential to success, and he can keep his eye on the quality of his seed with very little trouble.

There is clear proof that since testing has come into operation, and publicity has been given to the matter, the general average quality of farm seeds has improved. This is distinctly encouraging and should induce all those interested—the farmer most of all—to prove his farm and vegetable seed in every possible way. The whole of the work in this line is entirely in the interests of the grower.

Profitable farming largely depends on the use of good seed and the non-introduction of undesirable plants through weed seed planted with the crop.

The selection of seed has naturally a most important influence on crops. *Good* seed implies a reasonable proportion of mature seed, true to kind and variety, with only a small proportion (or none) of impurities or adulterants, with good capacity for germination and freedom from insect pests and disease, of at least average size and not old.

The chief causes of seed being poor are careless handling during harvest and afterwards, want of proper cleaning, seasonal circumstances preventing proper ripening, becoming damp from various causes, drying out, sprouting, dirty crops, mixture of old with fresh seed. All these causes should be borne clearly in mind.

The farmers interest in seed testing should be a very real one; he would save considerably in the long run by purchasing good seed. Many admit this, but in large seedings money considerations often stand in the way. Such seed gives larger returns, the resulting product would be superior, all the ground would be utilised, blank spots would not occur, so there would be no patches of bare earth to give weeds their opportunity. Undoubtedly, year in year out, a close attention to this question would save us money and prevent loss in crops; whilst it would be a potent factor in that important work of selection towards the best ends that all growers, consciously or unconsciously, are aiming at.

In selecting seed, appearance, size, colour, plumpness, brightness and smell are good general guides; but appearances are not always reliable.

It is not always easy to judge by eye; something more is needed. A little trouble in the matter is amply repaid. By carrying out a few simple tests we may save considerable expense and loss of time if the seed should not turn out ali it claims to be.

Seed is obtained from one of three sources: we may grow, buy, or exchange for it. We either get it on our own place, or obtain it from outside; mostly the latter plan is adopted.

The farmer, to protect himself, should certainly be in a position to know the seed he uses. He can, by the exercise of a few simple methods, examine all seed, and decide for himself as to its value for use. There is no excuse for any man sowing bad seed, for he has the opportunity to get it examined by sending it to this College for the purpose; or he might do it himself with sufficient accuracy for all practical purposes.

Of course it need not be supposed that tests for purity and germination always prove the actual value of the seed. In the case of some seeds, pedigree of the plant may be of greater importance than the germinating power of the seed; for example, a mangold seed with high germinating power might run principally to top, whilst one of less germinating power might grow a better root. Or, again, good seed as to germinating power may in some districts "bolt," or fail to form a root, while the same seed, sown in other districts, will under favourable circumstances produce a good crop. Fieaks of nature are not preventable; nor can unfavourable conditions always be overcome. We must not forget that good seed may not have the opportunities necessary for good development.* Moreover it is not always certain that seeds giving a certain test under indoor conditions will germinate equally well when planted in the field. We cannot, therefore, always blame the seedsman for failure of seed.

But for all grass seeds, and, indeed, seeds in general, purity with high germinating power and good weight, will give a pretty safe indication of their actual value. To be enabled to get at these matters accurately, it is absolutely necessary to make a test, accompanied by an examination of the sample, in a certain definite way, to be hereafter described.

Quality in Seeds is influenced by Age, Size, Weight, Smell.

Age.

Old seed is less likely to germinate than new. Loss of vitality is gradual, though more rapid in unripe than in well-ripened seed. With the exception of Cucurbit seed (melon, pumpkin, cucumber, gourd), it is safe to say that new seed is better than old; in fact, it is a mistake at any time to use seed more than two years old, and mostly it should not be more than one. The melon type of seed is better for use at two years than one, as new seed of this plant group will give more vine than is needed and not so much fruit as in cases where second-year seed is used.

* Board of Agriculture, England. Report on conditions under which Agricultural Seeds are at present sold.

Old seed can generally be judged as such by reason of its becoming dull and shrivelled, losing both colour and brightness.

As the result of a long series of experiments relating to the germinating capacity of old seeds, made in America, the average of twenty kinds of seed under vitality tests came out as under, conclusively proving that new seed is better than old :—

	Age of Seed.	Mature.	1 year old.	2 years old.	3 years old.	4 years old.	5 years old.	6 years old.	7 years old.	8 years old.	9 years old.	10 years old.
Average per cent. of twenty kinds of seed.	Per cent. germinated.	74	73	78	65	60	45	42	35	33	30	19

The following table has been given as a guide in this matter :—

(Do not use seed older than stated.)

Wheat ...	... 2 years.	Turnip...	... 3–4 years.	Kohl Rabi	... 3–4 years.
Oats ...	... 2 „	Swede ...	... 3–4 „	Clovers	... 2–3 „
Barley ...	... 1–2 „	Mustard	... 3–4 „	Sainfoin	... 1–2 „
Rye ...	... 1–2 „	Mangold	... 3 „	Lucerne	... 3–4 „
Maize ...	... 1–2 „	Carrot ...	... 3 „	Grasses	... 2–3 „
Peas ...	... 4–5 „	Cabbage	... 3–4 „	Flowers	... 1 year.
Beans ...	... 4–5 „	Kale ...	... 3–4 „	Vegetables	... 1 „
Buckwheat	... 2 „				

We have successfully germinated lucerne seven years old, and other seed that has also passed the number of years stated. We have also failed to germinate seed presumably fresh and good. Such cases are, however, not common, and can usually be explained as due to exceptional causes.

It may be taken as a fairly correct guide, that seed depreciates rapidly in value the older it becomes.

The tendency for seeds generally is to become weaker in vegetative powers as they age ; as weakness rather tends to fruitfulness, while strength gives vegetative growth, the reason why melon seeds of two or three years old are preferred by gardeners is explained. In most plants we require strength.

It is remarkable that seeds of the common garden stock will, if sown at once after becoming ripe, produce a large percentage of single-flowered plants ; if this seed is kept a few years, a weaker plant is produced with double flowers.

Beet and carrots grown from two-year old seed are said to form better roots ; the plant does not " run."

In chicory and cabbage, grown from three-year old seed, the plants are short and ripen better.

Spinach, lettuce, and radish grown from two-year old seed will run to seed.

Size.

There are great advantages from the use of large plump seed; hence all small seeds should be graded out and should not be used for planting purposes.

"Large plump seed is likely to be more healthy than small, and more likely to produce healthy plants. It can be sown more evenly because of its uniform size (if graded such). It has a larger percentage of growth and fewer failures. Plants from such seeds are larger and thriftier, and more resistant to disease, drought, and starvation. Crops from such seed have a more even growth, and are more economical to harvest and thresh. The yield per plant, both of grain and straw, is greater from such seed. The crop of grain grown from such seed has a higher market value, because (*a*) it contains more large grains and fewer small grains; (*b*) it is plumper and better looking; (*c*) it weighs more per bushel. The continuous use of such seed tends towards a general improvement in the quality of wheat."*

Grain crops derived from small seed give not only a lower yield of grain but a decided inferiority in quality, as the following results, obtained with White Velvet, will show:—

Grade— Seed planted.	Large seed. per cent.	Medium seed. per cent.	Small seed. per cent.
3·25 largest	18·6	13·9	12·4
3·00	34·4	38·7	27·7
2·75	32·2	31·6	38·1
2·50	12·7	12·6	17·0
2·25	1·5	2·3	3·7
2·00 smallest	·3	·6	·9
Tailings	·2	·2	·3

Nor does small seed germinate so well as large. The *failures* in 200 seeds, planted with an average of twenty-eight varieties tested, showed—

Large seed.	Medium seed.	Small seed.
6·2	9·3	17

Taking size of seed from another point of view, it has been shown "that if large seed of radish is used, about 90 per cent. of the crop reaches marketable size; if mixed seed is used, or seed as it usually comes to market, only about 45 to 50 per cent. matures."†

We may certainly conclude, then, that large heavy seeds usually produce more perfect plants than small lighter seeds, and consequently larger crops.

The variation in seeds is considerable, as is well known.

A plan has recently been put forward (V. A. Clark in New York Expt. Stn., Bull., 256), whereby seed can be selected by use of salt solutions. Admitting that heavy seed is best, and that seeds in any lot vary very much in size with a considerable range in specific gravity, the heavy can be separated from the light by using salt solutions of different strengths. The method is ingenious, but is hardly practicable for the farmer.

Weight.

Large seed is usually weighty, though not always so. Weight is an important factor in the selection of seed for planting. The standard per

* Dr. Cobb in *Agricultural Gazette*. † Proc. Am. Assn. Ad. Sc., 1895, p. 285.

bushel for any seed should be known and should be acted up to. Judging the weight by hand is not at all satisfactory, although the practice is commonly followed.

Seed giving light weight per bushel is poor, either in itself or from the large number of blanks therein. The matter of weight should, therefore, have careful attention in all seed selection.

Smell.

This is a good guide for the presence of mould or bunt. Musty seed is to be avoided at all times.

Relation between seed quality and amount to sow per acre.

There is a distinct relation between quality of seed and the amount to sow per acre. The amount required for seeding, as generally stated, refers to good quality seed; and if the seed used is below the standard, then the resulting stand will not be up to requirements. For example, take Prairie grass seed, with a standard weight of 15 lb. per bushel giving a germination test of 80. Now, suppose it germinates only 50; in every 10 seeds there will only be 5 develop plants out of every 8 there should be. This will mean the stand has but little more than half the plants it should have.

Or take a carrot field: the seed should germinate 85 per cent., but seeing that it is seldom this quality of seed is attained, take 70 as a reasonable value; if the seed only gives 40, as is often the case, the crop will carry barely more than half the requirements.

It will be seen, therefore, that a test is really necessary in all cases in order to find out the quantity of seed required to be added to the standard sowing in order to make up for such as does not possess the power to germinate. The standard sowing supposes seed of standard quality; anything below that requires that the amount sown should be increased.

An example will best illustrate the point it is desired to make:—20 acres are to be laid down to lucerne; 12 lb. per acre is to be the sowing. According to the appended table of standards, this seed should give a germination per cent. of 85, with purity per cent. of 98. The standard value is thus $\frac{85 \times 98}{100}$—that is, 83. Seed, should therefore show 83 as the actual value for weight as given. Seed, as tested here, has shown 64 per cent. germination test, 96 per cent. purity test; the value in use of this seed would be, therefore, $\frac{64 \times 96}{100}$—that is, 61. In this case, only 61 seeds would germinate in every 100, instead of 83. Now, the whole point of this is in the fact that if the grower wants his crop to come up with a certain definite covering of the ground, based on the supposition that 83 in every 100 seeds would germinate, if he uses the 61 per cent. seed he must add to the 240 lb. required 60 lb. extra to make up for the proportion that is actually no use. The loss is about one-fourth. He must, therefore, buy 300 lb. at least of the inferior seed in order

to secure the stand required. Of course, if the price is reduced in proportion it will not matter; 8d. a pound would have to be reduced to 6½d. to make things even. A farmer should know all about it, however, before the seed is sown, or he is not able to make up the deficiency shown to exist when the test is made.

Seedlings.

In raising seedlings, wherever there is any danger of insect trouble, as in the case of cabbage and cauliflower being attacked by the characteristic moth grub, the seed-beds may be protected by mosquito netting with advantage.

Seeds to be hand-sown will all bear soaking in water before being planted; the thicker and harder the seed coats, the hotter can the water be. Wattle seed, for instance, will stand being put in boiling water. Seed generally, however, should not be soaked in anything above 135 degrees Fahr.

Seedlings are raised under coloured glass at times, and with success. Red is the best colour to use; it allows of the useful heat rays passing to the soil beneath, whilst the rays having a chemical effect, the blue end of the spectrum are shut out, the red glass acting as a screen to prevent them passing through. Sugar-cane and other seed difficult to germinate may be treated in this way with greater prospect of success.

Fertilizers should not be in contact with Seeds.

In sowing, care should be taken that fertilizers do not come too much into contact with the seed, as in such case germination is poor or entirely prevented. We know one case where a pumpkin patch died out because the seeds were placed directly upon a handful of some chemical fertilizer, the whole being then covered with soil. Naturally enough, the young plants burnt off almost as soon as they appeared above ground. To give the young plants every chance, and prevent possible damage, fertilizers should not be placed near the seed or in drills in too great quantity, except it is well mixed with the soil. In the process of drilling in manure with seed there is sufficient mixture of the former with the soil to prevent damage to seed.

Notwithstanding this, under some circumstances it may be advisable to bring seed into close relation with a small quantity of artificial fertilizer; for instance, to prevent birds eating it, as is mentioned elsewhere.

Saving own seed for planting.

If it is intended to carry this out, certain points should be carefully attended to in the growing of the crops from which seed is to be taken. They should be grown where there will be little chance of crossing detrimentally. Cereals are, with the exception of maize, self fertilized; consequently this remark only applies to the latter amongst them.

Plants likely to cross should be grown as far apart as possible. Seed should be selected from the healthiest plants giving the best return, and not merely be taken from the largest heads of a crop; though grading away all small seed will undoubtedly assist in keeping up the average size.

Seed should be ripe, clean, free from impurities, and dry, and should be properly stored. The proper amount of moisture that seeds can safely lose, and retain their germinating power, is an important matter, a consideration as to which must be left to the expert seedsman. Seed should not be saved from crops infested with disease. Early seed can be selected for early varieties, from middle of ear, which ripens first; even a little before it is quite ripe. For late varieties select after seed is quite ripe, if possible from stalks not dead ripe. Early varieties may be expected to give light returns as there must be long growth for a heavy crop. If own seed has been frequently used, save and exchange it with someone having suitable varieties.

Adopting a regular habit of seed-testing brings the operator into touch with the importance of harvesting seed in first-class condition, so far as is possible to ensure its being ripe, clean, and pure. Such a frame of mind must be distinctly beneficial; the seed-tester proves for himself the benefits that follow use of good seed, and this must necessarily cause him to exercise the greatest care in any harvesting operations he may carry out.

This aspect of the seed question is well worthy of attention. Speaking generally, seed saving should not be entered into except methodically. It is better to leave it, with the necessary cleaning and other operations, to those who are equipped for the purpose, and have the experience.

Ripe and unripe seed.

Mature seed is always best for seeding purposes; it is fully ripe, and under favourable conditions is capable of properly carrying out the functions of germination—a most important matter in the rearing of young healthy plants. Immature seed is such as has not fully developed or ripened before it has been harvested; consequently the germs are not fully formed, whilst the food supply which is to support the germ on its commencing to develop is but poor—the young plants arising from such will lack vigour.

The use of unripe seed in tomatoes, for instance, encourages the production of fruit instead of stem and leaf, and also encourages early production. The resulting fruits and seeds are smaller, though there is an increase in their number. There is a loss of vigour seen in the small percentage of seed that germinate, in weakness of the seedlings, and in the fact that many die before maturity. Full vigour of the plants is never shown, though they produce an abundant harvest, and more rapid development occurs.

As showing the germinating powers of seed at different periods of ripeness, the following is an example, rye being the plant experimented with :—

		Per cent. seeds germinated.
June	26—Plant green, seed watery	$4\frac{1}{2}$
July	3—Plant green, seeds large, milky	5
,,	10—Straw begins to be yellow, seeds full of starch, green and soft	$9\frac{1}{2}$
,,	18—Straw yellow and dry, seed hard, not juicy	36
,,	30—Straw and grain dry, dead ripe	84

There is something to be done with unripe seed in the matter of raising early varieties.

Protecting seed against Birds.

Birds frequently take a considerable amount of certain seed sown during the first week or ten days after planting. To prevent this, soak the seed in tar water (1 lb. to 100 gallons).

Another method has been given as follows :—" First wet the seed by dipping a bushel or two at a time, contained in a bag, in a tub of water. Allow the grain to remain in the water for a few minutes, so as to get thoroughly wet, then lift the grain and spread it on a clean floor. When the required quantity of grain is thus prepared, dry it with superphosphate. Seed thus treated when sown will not be pulled up or eaten by birds."

Seeds and their Insect Pests.

Stored seeds are often attacked by insect pests. The cereals find their chief insect enemies in the grain weevil and the grain moth.

These, whilst feeding in the grub state within the seed, do not prevent the seed from germinating unless the germ is destroyed ; but the using up by the insect of the plant food store in the seed is distinctly detrimental to the young plant ; for on germinating, it is thrown upon outside sources for its food supply too early in life, consequent upon its own supply failing ; hence we may expect what really happens—a weakening of the young seedling at a time when it requires all the strength it can get. Further, the opening up of holes in seeds, with accumulation of filth consequent on the insect residing therein, will pave the way for disease germs, such as moulds, soil-residing fungi, amongst them bacteria, to make good a footing, and thus endanger the young plant at a critical stage of life.

The most prominent insects in seeds are, however, the weevils, found in peas and beans. This pest has been giving a large amount of trouble in Canada and certain of the States, where the cultivation of these crops have even had to be abandoned for a time. The insect deposits its eggs on the young pods of growing plants ; the grubs, burrowing into the seed and remaining there, are harvested with the seed, only to spread the pest further on, the perfect beetles coming out to reproduce their kind when the seeds are sown.

We have seen seed exposed for sale in the local stores showing the small circular depressions in the skin which indicate the presence of this insect therein.

All pulse should be carefully examined for this pest, and, if necessary, exposed to the fumes of some poisonous gas in a closed box. Bi-sulphide of carbon is the simplest remedy. The vapour is explosive, therefore care should be exercised in using it. A teaspoonful for every cubic foot of space may be placed in a saucer at the top of the box, in which the seeds to be fumigated have been arranged on shelves, or in some other convenient manner. The vapour sinks, being heavier than air, and envelops the seed. If this is done at night the seeds are ready for use next morning. Steeping in water at 140-150 degrees Fahr. will also kill the insects.

To keep weevils and mice away from seed, pour a little kerosene on it and stir it up well. For moderate quantities this is not expensive, and it is certainly a successful method.

Seeds and the introduction of Fungus Parasites to the Crop.

Many seeds are liable to convey to the ground, thence possibly to the seedling or growing crop, the germs of certain fungous diseases, such as smut and bunt.

For cereals it is advised to steep all seed for a quarter of an hour in hot water at 135 degrees Fahr., or in water in which sulphate of copper (bluestone) has been dissolved (1 oz. to 100 oz. water), for an hour; afterwards the seed should be dried by spreading in cloths, or it cannot be handled properly. Some workers sprinkle a little lime (after slacking) over the seed whilst it is wet. Formalin has been frequently advised as suitable for this purpose, but farmers are advised to continue using the blue stone or hot water method as the simplest and most reliable.

When there is the least doubt as to seed being clean—that is, free from possible fungus attack,—this process should be carried out. In the *Gazette*, Vol. XV, p. 670, Dr. Cobb put forward a scheme for determining with respect to disease germs (spores) on seed whether any are present, and if so the approximate number.

It must not be forgotten that seeds treated by steeping in sulphate of copper are likely to be damaged to some extent by the treatment. Some of them absorb sufficient of the chemical to kill them; this will happen more often where the steeping is kept up for any length of time. To give the seed every chance, and prevent excessive damage from this cause, powdered lime (fresh air-slaked), can be sprinkled over the seed when it is spread out to dry; or after being steeped in bluestone water it can be steeped in lime-water for a few minutes, or the seed can be steeped as a single operation in Bordeaux mixture, which is equally effective in the matter of germ destruction, and has none of the disadvantages attaching to the bluestone solution, if properly made up. With ordinary care, however, the loss of seed is not worth considering, and is certainly of no practical importance.

Whilst some cereals are liable to the attack of smut when well above ground (barley and maize), the main attack comes to the seedling before it has appeared above ground. It may be concluded, therefore, that although steeping the seed will not render all cereals absolutely free from smut, it is a safeguard to steep them all. The cost in cash and time is but light. By doing it the trouble is certainly kept down, and we are doing all we can, so far as present knowledge goes, to minimise this wide-spread disease. Steeping, if properly carried out, will kill all the germs that are attached to the seed, some of which would almost certainly inoculate the young seedling, if planted with their germinating power unimpaired.

(*To be continued.*)

Hawkesbury Agricultural College.

MONTHLY WEATHER REPORT.

Summary for August, 1905.

Air pressure (Barometer).			Shade Temperature.				Air Moisture 9 a.m. Saturation = 100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 13 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for 8 years.	% of the year's Evaporation.
29·62 30th.	30·46 23rd.	30·13	25·8 10th.	79·4 20th.	50·4	51·3	45 22nd.	95 11th.	69	0·203 30th.	2·552	2·132	5·6

Rainfall	12	25	26	27	29	Total,	Mean rainfall for 13 years.
Dates	12	25	26	27	29	Total,	for 13 years.
Points	3	trace	3	2	3	11 points.	2 inches.

Wind ...	N	NE	E	SE	S	SW	W	NW
	4	11	--	—	4	3	4	7

Thunderstorms on date—26th.

Frosts occurred on dates—3, 5, 8, 9, 10, 11, 12, 14, 15, 16, 17, 19, 22, 23, 24, 25, 28.

A cold month; only one August (1896) as cold since 1892.

The driest August recorded here; also the driest month since 1892. No three winter months—June, July, and August—have ever given so little rain—a total of 95 points. During these three months there were sixty frosts, giving a long continuous cold, dry period.

CHAS. T. MUSSON,
Observer.

Cotton Seed for Distribution.

The Department of Agriculture has a small quantity of new varieties of cotton seed available for distribution, including Early Carolina Prolific and Extra Long Staple Sea Island, in trial packets. In addition to these two varieties, Mr. John Millis, of Ashfield, has placed some locally-grown acclimatised cotton seed at the disposal of the Department for distribution in small lots. Application should be made to the Director of Agriculture.

Sub-Artesian Water Supply.

W. GIBBONS COX, C.E.

THE subject of sub-artesian boring as distinguished from deep boring for artesian water supply is a question that concerns a large number of pastoralists throughout New South Wales. Mr. W. Gibbons Cox, a well-known authority on boring for water, points out the simplicity of procuring water by this method in detail. The cost is very small compared with deep artesian boring, and the area over which this is practicable is very great in this State. Mr. Cox has had wide experience in this matter, and his article, which follows, should be of service to those whose properties lie within the area of sub-artesian water supply.—[ED.]

The progressive utilisation by boring of the deep artesian supplies of water, which have been proved to exist under enormous areas of country in Australia, especially in New South Wales, Queensland, and South Australia, has given an impetus to well-boring of all kinds, and the last disastrous drought, in raising the question of an increased water supply, has emphasized the vital importance of taking advantage of every source of supply, greater or lesser.

There can be no doubt that there are immense accumulations of water in the rocks and sands of the crust of the earth. Very little of that crust is, in fact, impermeable to water, whether it be by absorption or by pressure from above. What may be the actual quantity of water contained in the earth's crust must remain an unsolved problem. That it is enormous is certain. If it could be restored to the earth's surface it would doubtless raise considerably the ocean level, and encroach upon the lower reaches of the dry land. The passage of water into the crust of the earth has been going on for ages—ever since the cooling of the crust began. The water has, by gravitation, forced its way through the minute interstices of the strata, and it moves laterally through those strata in all directions until it meets a watertight wall or bed, or finds a vent at the lowest level attainable—the shores or bed of the ocean.

A very large portion of the rainfall—the source of all supply—sinks out of sight into the earth in so imperceptible a manner that it fails to impress itself on the mind as regards quantity or other conditions. Whatever the interior of the earth may be, whether solid or fluid, or partially so, the crust is porous. Even the hardest rocks are so constituted; granite itself has a percentage of water in its composition, although water will not pass freely through it. All the softer rocks, especially those of alluvial origin, are water-bearing. The dense compact limestones frequently hold great quantities of water in cavities and cavernous galleries, formed by the decomposition of

parts of the formation by the action of acids in water flowing from the surface. The numerous and successive deposits of alluvial strata, the sands and gravels interspersed with clay, are, as a rule, full of water.

In New South Wales there are many districts in which valuable shallow water has been proved to exist, and is now awaiting further utilisation by the borer's drill. Many of the stock and coach routes are supplied thereby and it may be obtained, notably in the Murrumbidgee-Lachlan basin; in the Cobar district; and easterly from the Barrier, and, in all probability near Broken Hill. In the coastal districts, both north and south, there are great areas of alluvial deposit lying in the "flats" adjacent to, and between, the numerous coastal rivers which are full of water of the best quality, and at exceptionally shallow depths—20 to 50 feet. These waters will prove of inestimable value to dairymen and others under increased settlement.

Sub-artesian water lies, as a rule, in the sands and gravels and newly-formed soft rocks of the post-tertiary, or newest upper, formations. A very large portion of the rainfall has sunk into this formation, and is lying conserved therein. A typical sub-artesian district may be given as follows:—The surface consists of rolling downs. "Weathering," or disintegration, of ranges, during ages of time, has formed, by the action of flood waters, large deposits of alluvial water-bearing strata in great wide stretches of country, which were formerly valleys between successive lines of ridges now showing above the sandy flats.

Grit is a descriptive term for this water-bearing formation, and it varies in its nature. In places it encloses a fine powder which is largely siliceous, and appears to be of volcanic origin. Elsewhere the grit is an aggregation of sand and lime. Then there is the mortar form, enclosing pebbles, quartz, feldspar, diorite, and other igneous rocks. Then the lime matrix almost disappears and we have a heavy conglomerate of water-worn pebbles of the rocks above mentioned, with jaspar, quartzite, and agate. The conglomerate changes at times into beds of a fair quality of water-bearing soft sandstone. There is no doubt that this tertiary grit exists under very extensive areas of New South Wales, and that its character for holding water is continuous throughout those areas. On level country it is covered up by a deposit of tertiary marl which tends to hold down the accumulated waters in the grit. The marl varies from 20 feet or 30 feet to 200 feet in thickness, and the grit from 20 feet to 100 feet. Wherever there are natural springs they are from the grit, and many of the springs might be tapped above their present outlet and their waters made available for extensive gravitation irrigation.

Many of the creeks of the interior are kept flowing by the abounding waters in the tertiary grit. The creeks are merely evanescent flood channels until they are cut down below the grit, and then their channels have a larger flow, except where hidden in sand which is largely the debris of the grit.

The sandy nature of formations—which in a large part of the downs or plains region are noted for their water-bearing capacity—is the main cause of the conditions which allow some of the creek valleys to have a sub-flow of water equal to, or perhaps greater than, that of the visible creeks. The

conditions of hydrostatic pressure under which the sub-flows exist suggest that their movements are directly related to those of artesian wells and springs.

Means of increasing this shallow water supply have suggested themselves to me after many years of close study in this country to the practical operations and bearings of boring for water. One of these is the feasibility of conserving a large amount of the sub-flow described above by forming a dam in a deep trench excavated in a dry season across the bottom of creeks, so as to prevent the passage to waste of a large quantity of the sub-flow from the upper reaches in their vicinity. This sub-flow from large areas of country now finds its way to the lowest level attainable, the bed of the creeks, and passes away. If it were intercepted by a low-level sub-dam it would remain penned up in the ground, and thus maintain a larger and more constant supply for bores in the vicinity to draw upon. It is a common practice to dig for water in the sandy beds of dried up creeks. The water may be found at first at a few feet below the surface, but in a few weeks time, or less, a greater depth is necessary to reach it. As evaporation could not have reduced the water level, it is clear that the level in the bed of the creek, and also in the adjacent country, must have been reduced by drainiage of the water laterally to lower levels, and, in many cases, finally out of the reach of shallow boring.

There must be, in fact, enormous quantities of water in the tertiary formation. The laws that operate in producing the deeper artesian accumulations apply in filling the upper porous strata. The deeper waters have their source mainly in the outcrop of great continuous sheets, or layers, of porous rock, which were originally deposited in the bed of a quiescent primeval ocean, and have since, with other strata, been subjected to geological upheavals and depressions. Some of the rain only that falls passes into the outcropping artesian rocks. A very large proportion falls on the general surface of the country, and sinks into the tertiary formations—the grits—which lie in local sheets, or layers, on the top of impervious clay or other water-tight strata.

Such is the general nature and condition of the shallow water-bearing formation. In many localities much of this valuable water is obtainable by drilling through unpromising strata, such as basalt—"blue stone,"—an accidental deposit of ancient lava, or through layers of limestone, or of hard dry sandstone, or tough compact shales. In many bores, after passing through the usual sand, clay, shales and soft rock, I have struck, at from 80 feet to 200 feet in depth, good and abundant water in the bed of buried creeks, clear evidence of which was shown by the sand-pump bringing up sand, gravel, and waterworn pebbles, and even native-made stone implements, from these ancient watercourses which were still in active operation as of old.

Many shallow bores, from 80 feet to 200 feet in depth, give true artesian "flowing" wells, and since the adoption of the deep-drilling machinery, and a greater exploration of the strata thereby, this has been quite common on many stations in New South Wales and Queensland, in cases where the boring

has been done near the outcrop of the artesian rocks. In many shallow bores the water has risen to within a few feet of the surface, so that by cutting a channel to lower ground the bores have become "flowing" wells.

The proper location of sites for shallow bores is of the greatest importance. Too much guess-work has hitherto prevailed. In fixing upon sites for the deeper artesian bores, maps made by the Mines Department from data afforded largely by the bores carried out, furnish valuable information; but in regard to the tertiary shallow water-bearing country, although likely districts are delineated, much necessary data must be obtained by the well-borers themselves. In examining country, reliance must be placed upon surface indications alone, viz., the lay of the land, the kind of tree growth, the outcrop of rocks and their kind, or surface formations, or rocks partially disintegrated, or entirely decomposed, the proximity of creeks, valleys, and low lying depressions, and the average rainfall of the district.

As it may appear remiss not to mention that long-lived perennial mystery, the "divining rod," in connection with locating subterranean water, especially the shallower, it will be well, without entering into a philosophical discussion of the subject, if indeed its nature would admit of doing so, to call attention to one important fact, viz., that the "science" has not established itself on an acceptable footing in Australia (which has presented a magnificent field for experimenting in), although its professors, past and present, may be counted by scores, and have had every encouragement, and every facility has been afforded them to prove their position. The notion is a very old one, and has had ample time to permanently establish itself if its value was equal to its pretensions. We should, in fact, doubtless have had, ere this, Government divination experts to further facilatate our researches for an increased water supply, and to determine the actual boundaries of the areas of underground water, the delineation of which will, I am afraid, have to be left mainly to the skill of the borers and their drills.

It has been found that, given the general surface indications as described, a well-borer of long experience, by utilising his knowledge and the intuition which has become, by a slow but sure process, natural to him, can locate boring sites with an almost absolute certainty of success, and that in cases where the strata he meets with do not promise well, he knows when to stop expenditure, and to try again further on.

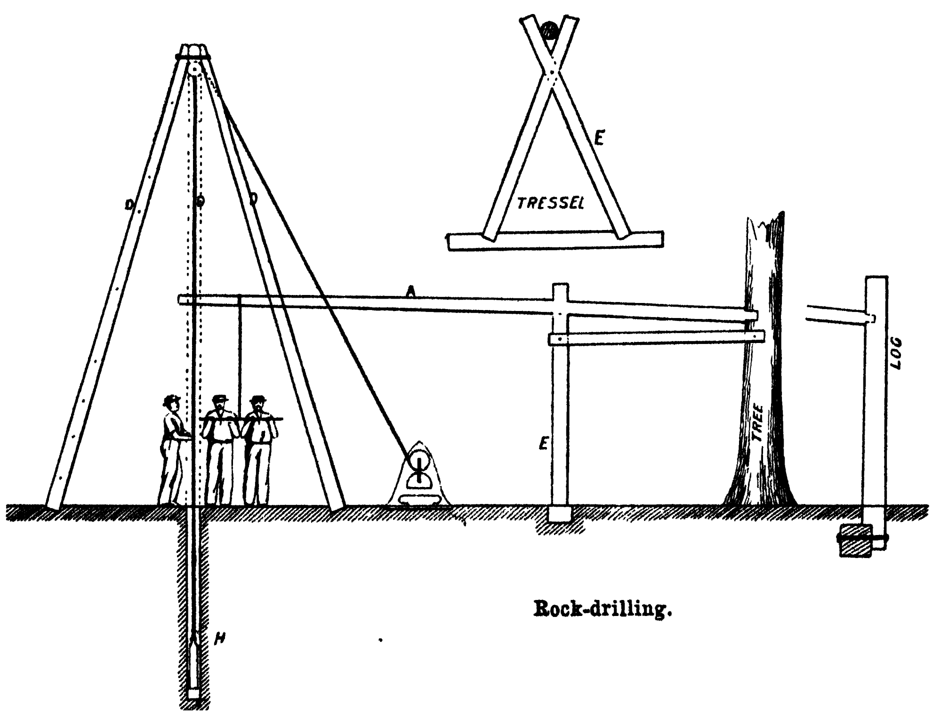
Machinery.

The question of the best mechanical means of getting this shallow water is one which practical well-borers with a large experience in this country, have, I believe, now set at rest. My own decision has been arrived at after many years of practical work and study in thirty-one districts of Victoria, New South Wales, and Queensland—mostly the latter—in boring on stations, and for agriculturists, and for railway purposes, part of the work having been done for the Governments of Victoria and Queensland, respectively. Various types of machines, both of English, American, and Australian make, have been used, all of which have been from time to time, placed in my charge. I

think it will be generally admitted that none of them have proved an unqualified success, the reasons for which have been complication of and too many parts, and a resultant lack of simplicity in the movements, both for boring in alluvial ground and for drilling in rock; liability to breakages in transit and working, or to some hitch or other in the complicated wrought and cast-iron mechanism, with its shafts, wheels, pulleys, chains, spiral, and bevelled screws, steel springs, and all the parts necessary in these systems, to effect the desired end. They require a skilled mechanic to make frequent repairs, and their cost is much greater than necessity requires for the purpose in view. No one will dispute the mechanical ingenuity displayed in their design, but the conditions of work in the bush—the interior of this country—have a law unto themselves, and are very different from those of work in a town or its suburbs.

The simplest, most effective, the quickest in working, and by far the lowest in cost, is a plant made with improvements on the "spring-pole" principle for drilling in rock, and with hand boring rods for alluvial strata.

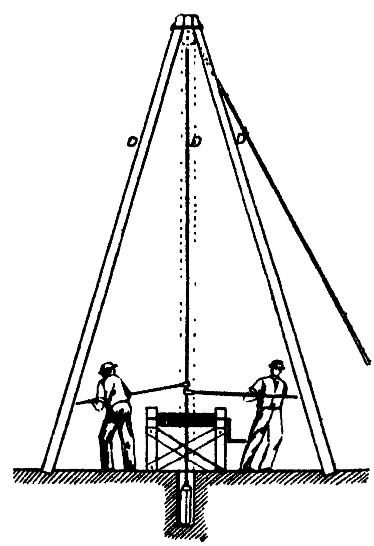
The accompanying illustrations show a side view and an end view of the derrick (D), the borer to start the boring, and the rock-drill at work. The



Rock-drilling.

derrick consists of three poles of bush timber, 20 feet long 5 inches butt, with a bolt through at top, to which are slung a large and a small pulley, working at right-angles to each other for the drill and the sand-pump ropes, respectively to work through from a large (C) and a small winch (B) at the foot. The drilling is done by means of a spring-pole (A), 25 feet long, 5 inches butt, preferably of ironbark, lancewood, or any elastic hardwood. The

butt end of the pole is tenoned and inserted at 9 feet from the ground, into a hole to fit it cut in a tree, or failing that, into a vertical log secured to a cross ground log. At 7 feet from the butt end the pole rests upon a tressel (E), also of bush timber, the height of the tressel being 10 feet, which throws the working end of the pole higher than the butt. A short hanging rope, with a cross-piece of wood forming handles for one or two workmen to pull down upon, is attached to the pole at the working end. Another short rope, also attached to the same end of the pole over the bore-hole, has an iron rope-clamp at the end of it, level with the cross-piece. In drilling in rock-after the cutting chisel, or bit, has been lowered to the bottom of the bore, hole by the large winch, the end of the pole is pulled down, the drill rope is then clamped on to the short rope connected with the end of the pole, the end of the pole let go, when its back spring lifts the drill, the movement being kept up by the workmen pulling down, with little exertion, the end of the pole and again releasing it without letting go the handles.



Boring in Alluvial.

Provision is made under this system by which any requisite power of spring, and lift and drop, may be obtained, and the force, speed, and number of blows per minute (regulated to a nicety by the workmen) are greater than in any other movement—not excepting that of the deep artesian machinery—I am cognizant of or can conceive. After carefully noting the working of the various other machines in use—the movements for lifting and dropping drilling tools,—I have found this spring-pole movement gives from 40 to 50 per cent. more blows per minute than any other, and it is, therefore, the most economical in practice as it is by far the simplest in construction and working. The spring of the pole being direct from the bearing on the tressel (E), is extremely sensitive, and the blows can, as pointed out, be adjusted in every way with the greatest nicety and precision. In rock drilling (I am not now treating of deep artesian drilling) with other machines, the power has to pass from the shaft through wheels, levers, pulleys, &c., before it operates in lifting and dropping the chisel, and in "tightening-up" or "recovery" after the blow has been delivered in order to give another one. The pole, on the other hand, lifts and drops by its own action and spring, direct within itself, the power applied being that of one or two workmen in starting and keeping up, with moderate exertion, the movement, no steam or horse-power being required.

An important feature of this apparatus is that, from its extreme simplicity, the timber work—*i.e.*, the derrick, spring-pole, tressel, and the sand-pump

winch—can all be made in the country of bush timber (the iron work only for these being supplied), the carriage and liability to breakage in transit being thus saved and avoided.

Ordinary wrought-iron boring rods are supplied if necessary for commencing the bore in alluvial ground for not more than say 30 feet, or until hard ground is met with, when the drill is used, worked by the spring-pole.

A sand-pump, consisting of a 5-inch tube with a valve at the bottom for drawing up the cut rock and cleaning out the bore-hole, is worked from the small winch. The large winch is an ordinary quick-movement contractor's winch, with a brake attached, for quickly lowering and raising the drilling bit. The small sand-pump winch is made of bush timber, the iron-work only being supplied. The working tools for rock drilling are identical in every particular with those used in deep artisean drilling, excepting that they are lighter. They consist of a chisel or bit, rimer, sinker-bar, jars, eye-piece for drill rope attachment, undercutting bit, sand-pump, ground-clamp, and clamp spanner, for lifting lowering and turning the casing, casing cap for driving the casing if required, &c., The tubing, or casing, used is the ordinary swelled joint 6-inch artesian.

It will be obvious that although this spring-pole plant is extremely simple in construction and working, it is necessary that the ironwork, including the working tools, be made at a foundry, and that the plant be set up, and started in a district by an experienced borer. Any ordinary workman can then work the apparatus.

The complete plant (excepting poles, tressel, and sand-pump timber winch), with drill and sand-pump ropes for drilling 200 feet, and 30 feet of boring rods, will cost about £50. Weight of the winch and all iron work, including boring rods for 30 feet, complete set of chisels, borer, and other tools, is 1½ tons.

Cracked Heels or Greases in Horses.

In cases where there is no fever, and the inflammation has not extended to the frog, cracked heels or greases may be treated with success without the aid of a veterinary surgeon; in severe cases, and with much local inflammation, fever, and a fetid discharge, a qualified surgeon should be called in. The main consideration in this and similar complaints is cleanliness and the guarding against circumstances favourable to the production of the disease. Pure air, a nourishing diet, and regular exercise are essential to success. At the outset, benzoated oxide of zinc, Condy's fluid, or an astringent lotion of sulphate of zinc, 3 drachms to a pint of water, may be used. If the surface is much swollen, a poultice of linseed meal or bran will help matters along. If horses' legs are washed or, after work, sweat is allowed to run into the heels without being dried, cracked heels frequently result. Some horses are predisposed; with such animals, additional care should be taken to give immediate attention. A bran mash or a mild laxative will assist in effecting a cure.

Irrigation.

A Few Hints on the Preparation of the Land and the Practical Application of Water.

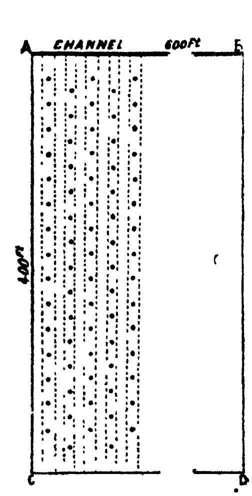
F. G. CHOMLEY.

There are many localities in New South Wales where supplies of water in sufficient quantity for irrigating purposes exist that are, unfortunately, not made use of. Thousands of cubic feet of water, running to waste from artesian bores, and millions of cubic feet are flowing to the sea in rivers; besides these large sources of supply there are many favourable places for the utilisation of wind-mills, oil-engines, and steam-pumps, but the methods of obtaining a supply of water is not the purpose of these notes, but rather to put in a simple manner a few hints, that may be of use to those who are fortunate enough to have a supply available, and who are not yet making use of it.

Preparing the Land.

It is assumed that the supply, from whatever source it is obtained, be it a public supply, pumped from tank, stream, or dam, &c., is available in sufficient quantity for the area to be brought under irrigated culture, and that it is delivered at the highest point on the land to be treated.

If the crop to be grown is one that is cultivated in rows, such as fruit-trees, vines, corn, or other crop, the most approved practical method of supplying water to them, is by means of furrows, and in the case of orchards, the deeper the better; in California, recent experiments have shown that furrows up to 12 inches in depth have given better results than shallow ones.

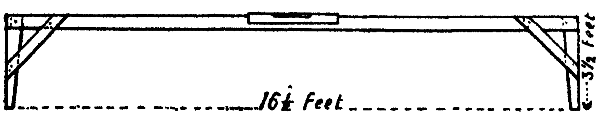


Plan of Orchard.

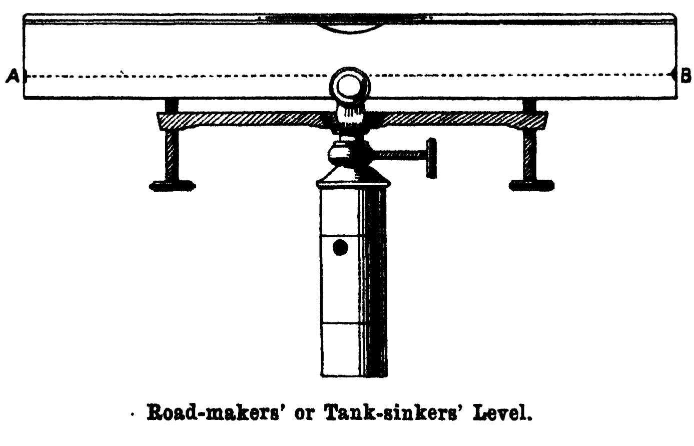
The most important thing at the outset is to prepare the land in a proper manner, in some places very little work is required, the land naturally having a suitable grade, but in cases where the grade is not suitable certain work must be performed to overcome this. Perhaps the clearest way of demonstrating this will be to take a specimen piece of land and trace the work from start to finish.

Suppose A, B, C, D, is a piece of land, the area about 5 acres, to be prepared for irrigation, and to be planted with fruit-trees. The supply is available, say, at A, the highest point, and that

there is a fall from A to B of, say, 3 feet, and from A to C of, say, 1 foot, and from A to D of 4 feet—these levels could be obtained by employing a surveyor, or they could be obtained in a simple way by using a form of A level —the A level is generally made of three battens, in the shape of the letter A, and a plumb-bob is suspended from the uppermost point, to swing vertically opposite a mark on the cross-piece when the two feet are level ; however, a more satisfactory and quicker level can be made as shown in the illustration. This level is quite accurate enough for small areas if a little care is taken in its use. Channels can be laid out and contours run by its means. A cheap form of tank-sinkers' or road-makers' level, obtainable at a cost of 15s. to 20s., somewhat similar to the illustration, mounted, at a convenient height, on a stake driven into the ground, will be found very handy ; as sights of $2\frac{1}{2}$ to 3 chains can be made with sufficient accuracy for this class of work. A light staff 10 feet long of 3 inches x 1 inch batten with a scale of feet and inches painted on its face in black on a white ground is required with such an instrument, and a bagful of pegs to mark the levels.



Modified A level, showing how an ordinary level may be used.



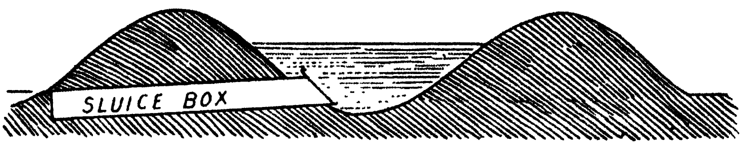
Road-makers' or Tank-sinkers' Level.

In the specimen piece of land, the best position for the head-ditch will be along A B, the furrows to run in the direction shown. A distance of 400 feet is quite long enough to run water in furrows for irrigation. A good wide headland should he left along the top of the orchard, allowing at least 4 feet for the ditch and 20 feet—24 feet would be more satisfactory—from the ditch to first row, making a headland 24 to 30 feet wide. With a narrow headland, the banks of the ditch and the sluice-boxes get broken by the horses turning on them when ploughing and cultivating.

It is advisable, in order that a good strong ditch can be formed, to draw some earth by means of the buck-scraper (see *Gazette*, March, 1905) from the field to make a slight bank along A B so that the banks of the ditch will be substantial and of a round form that can be walked on and not likely to

fall away. The ditch can be roughed out with a plough, and cleaned up to the section shown in the sketch with shovels. In a small permanent ditch there is no use for a crowder or other mechanical device for channel making; these implements are useful on larger undertakings, or in connection with irrigating cereals on a large scale.

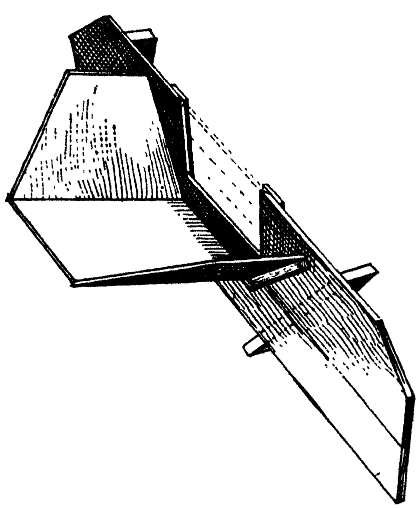
The size of the head-ditch depends on the amount of water available. A good size in this case would be 1 foot 6 inches wide on the water line. As there is a fall from A to B of 3 feet, it will be necessary to regulate the flow



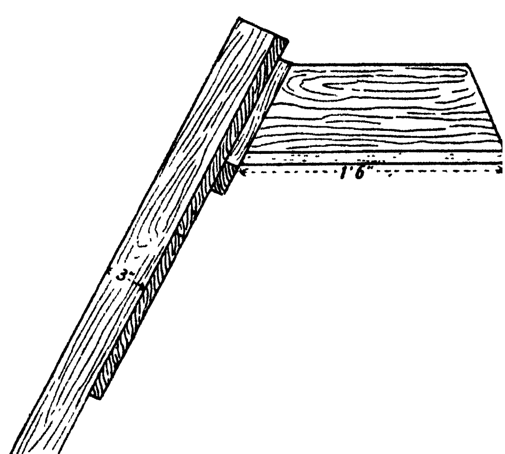
Section of head-ditch, showing sluice-box in position.

in the ditch by means of "drops" or small weirs; these can be made of sand-bags, or, more permanent ones, made of wood or concrete; a "drop" should be placed along the ditch every 6 inches of fall. This will enable the flow of water to be regulated so that every furrow can be kept running, or as many of them as are necessary or the supply will permit.

A serviceable "drop" for earth channels is shown in the sketch, precise dimensions are not given, for the simple reason that the drop must fit the channel, it should come well into the banks, and be fairly deep; this depends



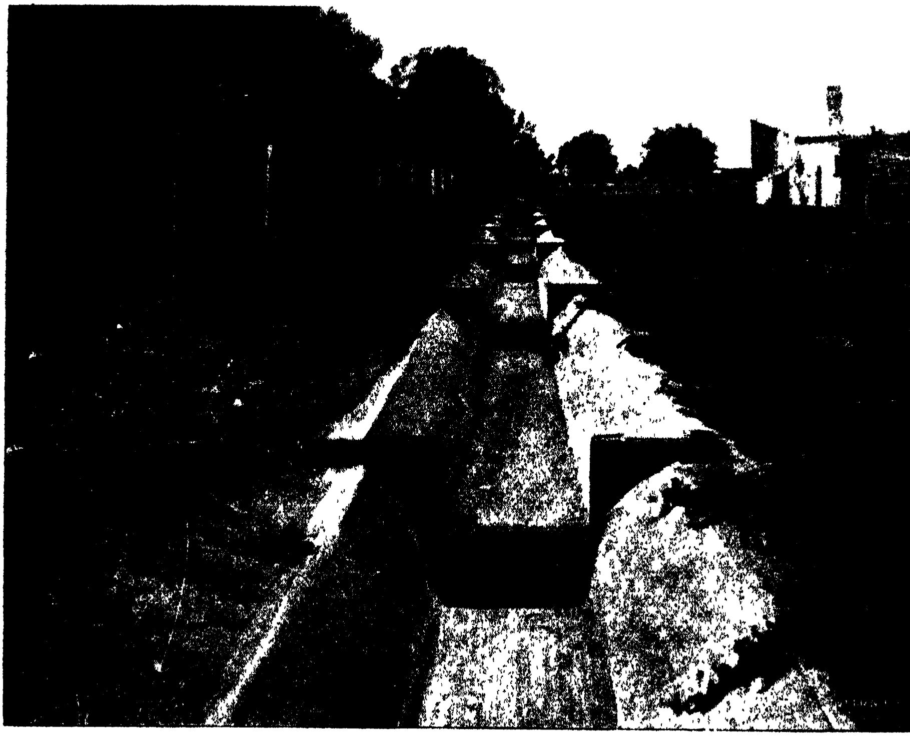
Wooden drop with apron for the water to fall on.
The dotted lines show regulating boards.



Side view of wooden drop and apron.

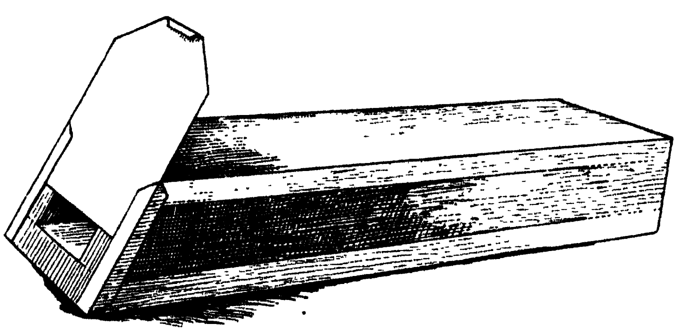
on the kind of soil. If they are built on the batter, that is, with a slant on them, the damp earth in drying after irrigation does not come away from the timber and leave cracks, a source of great trouble when next irrigating commences; the apron should project just far enough to prevent the falling water scouring a hole in the channel. If the channel is to be lined with concrete,

and this is strongly recommended, the drops can be worked in the material, no apron for the water to fall on is then necessary, nor is any wood, as is shown in this illustration, desirable, as the wood swells when wet and cracks the concrete; grooves for the depth boards can be cast in the concrete.



A concrete channel with gauge boards and drops.

Now comes the question of getting the water out of the ditch in small streams, by which means only can furrow irrigation be carried out. As a makeshift cuts can be made in the bank with the shovel, and choked with weeds



Sluice-box with regulating slide.

to regulate the water to a small stream, but it is far more economical to have sluice-boxes that can be controlled. The simplest form the writer has experience of is of the form shown in the illustration, a square wooden pipe is made of red gum or any good lasting wood, 4 inches square and

4 feet long, from two lengths 4 x 1-inch, and two lengths 2 x 1 inch stuff nailed together, and cut in half on the slant, making an angle about 30 degrees to the perpendicular. On each side of the pipe at the slanting cut-end a piece of galvanised-iron, bent in the form shown, is nailed with small flat-headed nails. This makes a spring guide to carry a flat galvanised-iron slide. As the saw-cut must leave a flat surface the flat iron slide fits tight, while the springy guides maintain it in position. Any man who

Orchard in process of being irrigated.

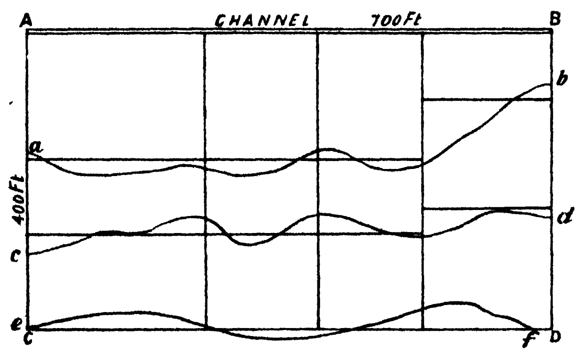
can drive nails and use a saw can make these very quickly. This size gives a clear hole 2 inches square, and about 2 feet long, but a smaller hole is generally sufficient.

This completes the fitting of the channel. If the level shows any hollows lying in the direction in which the water is to run, or any hills over which the water will not go even when a furrow is drawn, these must be reduced by means of the buck-scraper and smoother described in the *Gazette*, March, 1905, but with such a fall it is not likely that much of this work will be required—especially when the depth of the furrow is taken into account; before starting to plant, test the land with water to find out how the levels are, by ploughing furrows every 20 feet apart and letting water along them, marking any places with stakes requiring filling in or reducing; it is easier to grade land before planting than after.

In irrigating any crop such as fruit-trees, vines, maize, &c., where furrows are used to carry the water care must be taken to let the rows from top to bottom get an equal supply—a bad irrigator will have the growth heavy at each end and stunted in the middle—run a fair stream down the furrow, say half way, and then close down with the slide to a trickle that will take some time to reach the bottom. By cutting one furrow into another and regulating the sluices an even wetting without any flooding of the surface (which is very harmful) can be achieved.

Preparing Land for Irrigation in Checks.

Should the nature of the crop necessitate the flooding of the land such as is the case with lucerne, &c., it will be as well to choose land as near level as possible with a gentle fall one way. Suppose, for instance, the piece of land is shaped like the piece in the illustration.



Rough plan, showing contour lines and proposed checks.

With the level it is found that A B is nearly level, the fall from A B to C D is 9 inches. Starting at A, work along A C till 3 inches of fall is shown at *a*; then from (*a*) work along this level—marking by stakes, or lockspits made with a shovel — then work along A C till it shows 3 inches further fall at (*c*); contour again towards B D; repeat, starting at (*e*). In setting out checks, 3 inches is a good difference in level to make contours; if less, trouble in grading with scoop or buck-scraper will be found; if more, there is too much earth to move, making the work very expensive. Having these levels marked on the ground, make a rough sketch to scale, and plan out divisions for banks, keeping the checks rectangular and of about equal area, if practicable, and not more than half an acre each. It is a mistake to have the checks too large; water is wasted and the crop does not receive an even supply. The lines of division being decided on, mark them out, and with the buck-scraper draw soil from the high to the low portions to level the land and form the retaining banks. The banks should be flat, 6 inches in height by 3 to 4 feet wide, so that mowers and rakes will work over them.

Section of a good bank. **Section of a bad bank.**

The supply-ditch should run along A B, with sluices leading into each of the top-checks, and from these checks cuts should be made, or permanent sluices made of wood, provided to let water into the lower ones in order; these, however, are often in the way of machinery. With low banks, such as described,

with each check very nearly level and not too large, very even distribution can be effected. Provision should be made to allow any water not absorbed in twenty-four hours to escape, as considerable harm will result by scalding &c., if allowed to remain.

In practice, many little difficulties will present themselves, to enumerate all the troubles possible to meet is the work of a pessimist. In California, and Mildura, Victoria, every conceivable obstacle has arisen; and has been for the most part overcome. At one time, in California, when water was of less value than now, most extravagant waste took place (as is the case in Victoria now), the result being in many cases ruination of the soil; the present tendency is less water and more cultivation, the result being better crops and a great saving of water. Owing to the cost of materials in Australia, few, if any, of the systems of pipe irrigation can be adopted. Iron is used in California in conjunction with canvas duck hose, pipes being 8 to 9 inches in diameter; cement pipes are also used, being cast in moulds, and laid below the surface, out of the way of ploughing. Wooden flumes, made of Redwood, are also in vogue, but there is no suitable Australian wood for this purpose; the ordinary hardwoods warp and shrink too much. Concrete on a wire-netting foundation—on the Monier system—has given good results in Australia. Concrete channels (as used at Mildura) are built in position, the ditch being formed carefully, and the concrete laid on like mortar, and dressed to size by a gauge. The proportions are:—

Lime	5 bushels.
Sharp sand and gravel (lime-stone rubble) ...	$1\frac{1}{2}$ cubic yards.

In the Bacchus Marsh district of Victoria, where the soil on the river flats used for lucerne is very porous, calico hose is largely used, and seems the only method possible under the circumstances. The hose is led from the head-ditch across the lucerne field; the hose is in handy lengths, and is joined together by inserting one piece into another about 3 feet; the slight pressure on the hose keeps the join tight. As an area is treated, the attendant removes a length and leaves it a few yards to one side to be joined up for the next row; a long pole with a hook is used to move the outflow end as the soil gets too soft to carry a man.

Too much scoop work should not be done to level land for flooding, unless there is a great depth of soil; better have more check banks and smaller checks than patches of subsoil in the area.

There are a few points in connection with water and water supply that might be touched on that may be of some use to those who are giving attention to utilising the water now running to waste. The first thing that confronts one is the unsatisfactory reference to miners' inches, gallons per diem, cubic feet per second, &c., all mixed in the most bewildering way, that gives absolutely no idea of the amount of water in question to the ordinary man. Artesian bores are generally spoken of as giving flows of so many million or thousand gallons per twenty-four hours; the flow of rivers is given in cubic feet per minute or second; while in California the water supply for irrigation is spoken of and sold by miners' inches—a variable quantity, depending on many circumstances—the seller's idea changes as water gets scarce. In

larger schemes the term acre-feet (for water at rest) has come into use; this is a good, sensible, easily understood unit Anyone can grasp what an acre of land, covered 12 inches deep, means.

It would, however, be more satisfactory if all measures of flow were expressed in cubic feet per second. We would then get used to reckoning in these units, and when a flow of 50 or 100 cubic feet per second was mentioned, we would have some idea of its volume and value.

In many text-books and articles on irrigation emanating from California, the miners' inch is used as a measure of flow. This, no doubt, has arisen from the fact that mining preceded irrigation on ranch and farm in that and adjacent states, and the miners used the inch measure as a rough and ready way of dividing streams for sluicing and other mining purposes. The accepted standard for the miners' inch in California and Colorado is the amount of water that will flow through an inch square hole in an inch board, under a 4-inch head, and has been found by trial to yield about one-fortieth of a cubic foot per second, or, by calculation for this class of orifice = ·0231 cubic feet per second. In practice, a 50-inch stream, or head, would be in excess of the supply due on the above basis, as the means of measuring a 50-inch stream is not subject to the same conditions, as a slot about 2 to 2½ inches wide and 25 or 20 inches long is used, the head varying from 4 to 7 inches. When water is scarce, the miners' inch shrinks to about one-fiftieth of a cubic foot per second—thus no great reliance can be laid on any measurements given in miners' inches.

When a 50-inch head is spoken of, it generally (or at least in the portions of California around Riverside) means a fair stream to irrigate 10 acres of orchard in twenty-four to thirty-six hours, and will, approximately, equal 2 inches deep all over the area.

Keeping in mind that 1 cubic foot per second, or 60 cubic feet per minute, is equal to a covering of 2·37 inches—say 2⅓ inches—of water on ten acres in twenty-four hours, we have a simple unit that is neither hard to conceive nor remember.

The Imperial gallon is equal to 1·2 U.S. gallons; 6·24 (say 6¼) Imperial gallons, or 7½ U.S. gallons, are equal to 1 cubic foot; thus when the amount of water used on American farms or orchards is given in gallons it should not be forgotten that this difference exists.

One inch of rain on an acre of land is equal to 22,620 Imperial gallons, or roughly 23,000 gallons. One cubic foot (or 6¼ gals.) per second flowing constantly may be considered as capable of irrigating about 200 acres of cereals, or 400 acres of orchard or vineyard, providing the annual rainfall is not below 15 inches—lucerne takes far more water than either cereals or orchard—the loss from evaporation being greater, apart from the extra amount of produce grown, and the fact that the water is mainly required during the late spring and summer.

Articles on Irrigation have appeared in the *Gazette* at various times, to which the reader is referred for much useful information. (*Vide Agricultural Gazette*, vol. X, 1899, pages 717 and 1268; vol. XI, 1900, page 521; vol. XIV, 1903, pages 385, 1090, 1143; vol. XV, 1904, pages 353, 637, 807.)

A List of the Insectivorous Birds of New South Wales.

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Ornithologist, Australian Museum.

PART VI.

IN Volume XIII, p. 407, 1902, of the *Agricultural Gazette*, the remainder of the species of the strictly insectivorous birds of New South Wales was enumerated. The second section of the subdivision consists of those birds inhabiting the State which are only partially insectivorous, but generally useful. The concluding section enumerates a list of birds also partially insectivorous, but likewise frugivorous, or granivorous, and all more or less harmful.

SECTION II.

BIRDS PARTIALLY INSECTIVOROUS.—GENERALLY USEFUL.

120. PODARGUS STRIGOIDES, *Latham.* Tawny-shouldered Podargus, or "Frog-mouth."

Podargus humeralis, Gould, Bds. Austr., fol. ed., Vol. II, pl. 3 (1848).
Podargus strigoides, North, Nests and Eggs, Austr. Bds., p. 26, pl. VI, fig. 3 (1889).

This species, known to many residents in the country by the local and erroneously applied name of "More-pork" or "Mopoke," is freely dispersed over most parts of New South Wales. It is a quiet and inoffensive species, and is usually met with during the day asleep and perched across or along a branch, or in the thick forked stem of a *Eucalyptus* or *Casuarina*. The food of the Tawny-shouldered Podargus consists of various species of mantis, locusts, beetles, and all kinds of nocturnal insects; to this diet is added small frogs. It is a most useful bird and should be rigorously protected. The nest of this species is usually a loosely-built structure of thin sticks placed across the horizontal branch of any suitable tree. Eggs, two or three in number for a sitting, elliptical in form, and pure white.

121. PODARGUS PLUMIFERUS, *Gould.* Plumed Podargus.

Podargus plumiferus, Gould, Bds. Austr., fol. ed., Vol. II, pl. 6 (1848).

A rare species found only in the scrubs and brushes of the northern coastal districts of the State.

NOTE.—Contributions from the Australian Museum, by permission of the Trustees.

122. DACELO GIGAS, *Boddaert.* Great Brown Kingfisher, "Laughing Jackass," "Laughing Kingfisher."

Dacelo gigantea, Gould, Bds. Austr., fol. ed., Vol. II, pl. 18 (1848).
Dacelo gigas, North, Nests and Eggs, Austr. Bds., p. 36, pl. VI, fig. 1 (1889).

A familiar and well-known species frequenting open forest country and the timber-clad mountain ranges of eastern New South Wales. In the dry western portions of the State it is only met with in the neighbourhood of rivers and watercourses, or wherever there is permanent water. For the purposes of breeding it deposits its beautiful pearly-white eggs, which are three or four in number for a sitting, on the decaying wood in the hollow limb of a tree. Insects form only a portion of this bird's food, but it is useful in ridding the country districts of rats, mice, lizards, centipedes, and occasionally small snakes. It will also pounce down and capture young chicken. When the latter have the run of the bush, entire broods have been destroyed in the outlying suburbs of Sydney. The contents of the stomachs of many birds of this species I have examined proves that lizards is the staple article of their diet; but the food varied according to the different situation and features of the district in which the specimens were obtained.

123. HALCYON SANCTUS, *Vigors and Horsfield.* Sacred Kingfisher, Common Tree Kingfisher.

Halcyon sanctus, Gould, Bds. Austr., fol. ed., Vol. II. pl. 21 (1848); North, Nests and Eggs, Austr. Bds., p. 37 (1889).

A partial migrant arriving in New South Wales in August and departing again at the end of February; stragglers are, however, occasionally met with during the intervening months. It usually deposits its fine pearly-white eggs on the decaying wood in the hollow branch or hole of a tree, or in a chamber hollowed out at the extremity of a tunnel it excavates in the nest of the white ant. The food of this species varies according to the class of country it frequents. Inland, where this species is far more freely distributed, it consists principally of insects and their larvæ and small reptiles. Near the coast, crustaceans form its chief article of diet, like that of its Queensland congener, *Halcyon sordidus*.

124. HALCYON PYRRHOPYGIUS, *Gould.* Red-rumped Kingfisher.

Halcyon pyrrhopygia, Gould, Bds. Austr., fol. ed., Vol. II, pl. 22 (1848).
Halcyon pyrrhopygius, North, Nests and Eggs, Austr. Bds., p. 38 (1889).

The Red-rumped Kingfisher is a summer visitant to the inland portions of New South Wales. It frequents most arid situations, and is seldom met with except for the purposes of breeding in the vicinity of water. This Kingfisher excavates a tunnel in the side of a dam or old disused saw-pit, and at the end deposits four pearly-white eggs in a chamber hollowed out for their reception. Its food consists of insects and their larvæ and small reptiles, principally lizards.

125. Halcyon macleayi, *Jardine and Selby*. Macleay's Kingfisher, Bush Kingfisher.

Halcyon macleayi, Gould, Bds. Austr., fol. ed., Vol. II, pl. 24 (1848); North, Nests and Eggs, Austr. Bds., p. 38 (1889).

This species is found only in the rich brushes of the northern coastal districts. It breeds principally in the nests of the white ant; the eggs are five in number for a sitting, of a beautiful pearly-white when fresh. The food of this species consists of insects and their larvæ, and small reptiles.

126. Cinclosoma punctatum, *Vigors and Horsfield*. Spotted Ground Thrush.

Cinclosoma punctatum, Gould, Bds. Austr., fol. ed., Vol. IV, pl. 4 (1848); North, Nests and Eggs, Austr. Bds., p. 151, pl. XI, fig. 10 (1889).

A resident species found in most parts of the State. It is usually met with in scrubby localities, or in lightly timbered country with a slight undergrowth. The nest of the Spotted Ground Thrush, which is built upon the ground, is a loosely-built structure composed of strips of bark, grasses, and leaves, and is usually well concealed under a clump of bracken fern, or in the low undergrowth in close proximity to an old stump or fallen tree. Eggs, two or three in number for a sitting, of a dull white, thinly freckled or heavily blotched with umber-brown, wood-brown and violet-grey markings, the latter colour usually appearing as if beneath the surface of the shell. Insects and their larvæ obtained among fallen timber, berries, and seeds constitute the food of this species.

127. Cinclosoma castaneonotum, *Gould*. Chestnut-backed Ground Thrush.

Cinclosoma castaneonotum, Gould, Bds. Austr., fol. ed., Vol. IV, pl. 15 (1848).

In habits and mode of nidification the Chestnut-backed Ground Thrush resembles the preceding species. It is, however, a rare species in New South Wales, its range being restricted to the dry scrubby localities of the western portions of the State.

128. Geocichla lunulata, *Latham*. Mountain Thrush.

Orcocincla lunulata, Gould, Bds. Austr., fol. ed., Vol. IV, pl. 7 (1848).

Geocichla lunulata, North, Nests and Eggs, Austr. Bds., p. 171 (1889).

This species frequents the humid scrubs and slopes of mountain ranges of eastern New South Wales; it passes most of its time upon the ground, searching among the fallen timber and moss-covered stones for various kinds of insects and their larvæ, small molluscs, and worms, which constitute its food. The nest of the Mountain Thrush is usually built in the thick fork of a tree; it is a round open structure composed of thin strips of bark and mosses, lined with fibrous roots, the rim of the nest being very thick and neatly rounded. The eggs are five in number for a sitting, and vary from a light stone to a greyish-green ground colour, and are minutely freckled all over with reddish-brown markings. This species commences to breed in July, and continues the five following months.

129. LEUCASARCIA PICATA, *Latham*. Wonga Pigeon.

Leucasarcia picata, Gould, Bds. Austr., fol. ed., Vol. v, pl. 63 (1848); North, Nests and Eggs, Austr. Bds., p. 272 (1889).

This fine pigeon frequents the rich brushes and mountain ranges of eastern New South Wales. Seeds and berries constitute the principal portion of this bird's food during the summer and autumn months, but in the early spring it feeds largely upon dipterous larvæ, which are all known to be very destructive to grass. The nest of the Wonga Pigeon is a flat structure of sticks and twigs placed crosswise on the horizontal branch of a tree, and is usually built at no great height from the ground. Eggs, two in number for a sitting, pure white.

130. EUPODOTIS AUSTRALIS, *Gray*. Australian Bustard, "Native Turkey," "Plain Turkey."

Otis australasianus, Gould, Bds. Austr., fol. ed., Vol VI, pl. 4 (1848).

Choriotis australis, North, Nests and Eggs, Austr. Bds., p. 296.

A well-known species sparingly distributed over the inland portion of the State and much sought after as an article of food. It lives on grasses, seeds, and insects to a large extent. This bird usually lays one, sometimes two eggs for a sitting, of an olive-brown, spotted and blotched, with markings of a deeper hue.

131. ŒDICNEMUS GRALLARIUS, *Latham*. Southern Stone Plover, "Bush Curlew," "Stone Curlew."

Œdicnemus grallarius, Gould, Bds. Austr., fol. ed., Vol. VI, pl. 5 (1848); North, Nests and Eggs, Austr. Bds., p. 297, pl. XIX, fig. 3 (1889).

This bird, from its peculiarly mournful note, which is uttered at night and resembles "Koo-loo," is better known to most residents in the country districts of New South Wales under the local name of "Curlew." Care, therefore, must be taken not to confound it with the true Curlew (*Numenius cyanopus*) of the coast, a bird generically and specifically distinct. The Southern Stone Plover evinces a decided preferences for open forest country or grassy plains. It deposits its eggs, which are two in number for a sitting, upon the bare ground. In addition to insects of various kinds, small frogs, land molluscs, and worms form the principal portion of this bird's food. This species is often kept in gardens and orchards to clear them of grubs, snails, &c.

132. LOBIVANELLUS LOBATUS, *Latham*. Spur-winged Plover, "Alarm-bird."

Lobivanellus lobatus, Gould, Bds. Austr., fol. ed., Vol. VI, pl. 9 (1848); North, Nests and Eggs, Austr. Bds., p. 300 (1889).

A common species in New South Wales. It frequents alike the margins of swamps and shallow lakes, open grass lands, and the dry plains. Grasshoppers and worms, and small aquatic insects obtained from the edges of

swamps, constitute this bird's food. The Spur-winged Plover usually breeds during August and the two following months, depositing its eggs, four in number, upon the bare ground. The eggs vary from olive-brown to olive-green in ground colour, and are uniformly spotted and dotted with deep blackish-brown. This bird uses every device to attract one away from its eggs or young, by feigning lameness or a broken wing, uttering all the time loud notes of distress. A very useful species to keep in a garden.

133. SARCIOPHORUS PECTORALIS, *Cuvier*. Black-breasted Plover, "Plain Plover."

Sarciophorus pectoralis, Gould, Bds. Austr., fol. ed., Vol. VI, pl. 11 (1848); North, Nests and Eggs, Austr. Bds., p. 302, pl. XVII, fig. 6 (1889).

A plain inhabiting species widely distributed over the inland districts of the State. It usually commences to breed in August and continues the two following months, but like many species of grallatorial birds, the breeding time of the Black-breasted Plover is greatly influenced by the wet season being early or late. After an excessive rainfall at the end of autumn, the eggs of this and many other species of *Charadriidæ* are found as early as May. The eggs of this plover, usually four in number for a sitting, are deposited in some slight depression in the ground, or on the top of a small mound a few inches above the level of the surrounding plain; they are of a light olive-brown ground colour, thickly spotted and dotted with different shades of brown, and a few indistinct subsurface markings of bluish-gray. The food of this species consists of worms and the various kinds of insects found upon the plains and grassy flats which it frequents.

In addition to those enumerated above, several species of hawks, owls, ibises, and the silver gull devour large numbers of insects at certain seasons of the year.

SECTION III.

III.—BIRDS PARTIALLY INSECTIVOROUS, FRUGIVOROUS, AND GRANIVOROUS—MORE OR LESS HARMFUL.

134. STREPERA GRACULINA, *White*. Pied Crow-Shrike, "Black Magpie," "Fruit-eating Magpie."

Strepera graculina, Gould, Bds. Austr., fol. ed., Vol. II, pl. 42 (1848); North, Nests and Eggs, Austr. Bds., p. 55 (1889).

The present species is freely dispersed throughout the mountain ranges and open forest lands of New South Wales. Berries and fruits constitute the principal portion of this bird's food during the summer months, and the larvæ of insects to no small extent in autumn and winter. The Pied Crow-Shrike, or "Black Magpie" is, however, better known to orchardists and agriculturists by the depredations it commits in fruit and grain crops; consequently a merciless warfare is waged against it, but without any apparent diminution in its numbers. The nest of the Pied Crow-Shrike,

which is usually built in a Eucalyptus or Casuarina, is a large open bowl-shaped structure outwardly composed of sticks, and lined with strips of bark and grasses. Eggs, three in number for a sitting, of a pale chocolate brown, faintly spotted and blotched with vinous brown markings.

135. STREPERA CUNEICAUDATA, *Vieillot.* Grey Crow-Shrike, "Grey Magpie."

Strepera anaphonensis, Gould, Bds. Austr., fol. ed., Vol. II, pl. 45 (1848).
Strepera cuneicaudata, North, Nests and Eggs, Austr. Bds., p. 55.

Although fruits and berries form portion of this bird's food, it seldom enters into orchards and gardens in search of cultivated fruits as does the preceding species.

136. GRAUCALUS MELANOPS, *Latham.* Black-faced Graucalus, "Blue-Pigeon," "Blue-Jay."

Graucalus melanops, Gould, Bds. Austr., fol. ed., Vol. II, pl. 55 (1848); North, Nests and Eggs, Austr. Bds., p. 74, pl. IX, fig. 4 (1889).

A fairly common and widely-distributed species, found over most parts of the State. Insects of various kinds constitute the principal portion of its food, but it commits depredations in orchards and vineyards.

137. GRAUCALUS MENTALIS, *Vigors and Horsfield.* Varied Graucalus, "Smaller Blue-Jay."

Graucalus mentalis, Gould, Bds. Austr., fol. ed., Vol. II, pl. 56 (1889); North, Nests and Eggs, Austr. Bds., p. 75 (1889).

Similar in habits to the preceding species, but not so frequently met with.

138. CORCORAX MELANORAMPHUS, *Vieillot.* White-winged Chough, "Organ-bird," "Black Magpie."

Corcorax leucopterus, Gould, Bds. Austr., fol. ed., Vol. IV, pl. 16 (1848).
Corcorax melanorhamphus, North, Nests and Eggs, Austr. Bds., p. 189 (1889).

The White-winged Chough is freely distributed over most parts of New South Wales, but is more frequently met with inland than near the coast. The nest of this species, in which often several birds assist in its construction, is a large bowl-shaped structure of mud with a slight lining of dried grasses or decaying bark fibre, and is built on the horizontal branch of a tree, in any convenient situation. The eggs are usually four or five in number for a sitting, but as many as eight have been found, probably the result of two females depositing their eggs in the same nest. The eggs are dull white, blotched all over with olive and blackish-brown markings, while beneath the surface of the shell appear many deep bluish-black spots or blotches. The food of this bird usually consists of insects of various kinds. Mr. A. M. N. Rose, of Campbelltown, however, informs me that in the neighbourhood of Blacktown, this species has been frequently trapped and shot while attacking and eating the maize.

139. CORONE AUSTRALIS, *Gould.* Australian Raven.

Corvus coronoides, Gould, Bds. Austr., fol. ed., Vol. IV, pl. 18 (1848).

Corone australis, North, Nests and Eggs, Austr. Bds., p. 187, pl. VII, fig. 7 (1889).

A common and well-known omnivorous species found all over the State. It is useful in ridding cleared lands of large numbers of insects and grubs, but it is very destructive amongst young lambs, and is a notorious nest-robber. Newly-planted grain crops also suffer by the depredations of large flocks of these birds; and in the neighbourhood of Seven Hills and Blacktown it has (now twelve years ago) added oranges to its already extensive and varied diet.

140. CORVUS CORONOIDES. *Vigors and Horsfield.* Crow.

Corvus coronoides, North, Nests and Eggs, Austr. Bds., p. 186, pl. VII, fig. 8 (egg), 1889.

This bird differs only from the preceding species in its much smaller size, and in having the basal portions of the features, upper surface, pure white. It is, however, not so numerous or so destructive as *C. australis*, its food consisting chiefly of insects, small reptiles, berries, and seeds. Both species are known as "Crows."

141. ORIOLUS SAGITTATUS, *Latham.* Green Oriole, "Green-backed Thrush," "Fruit Thrush."

Oriolus viridis, Gould, Bds. Austr., fol. ed., Vol. IV, pl. 13 (1848).

Mimeta viridis, North, Nests and Eggs, Austr. Bds., p. 183 (1889).

A common species in the coastal shrubs and mountain ranges of eastern New South Wales. Insects, berries, and fruits constitute the food of this species. It commits great havoc in orchards and vineyards.

142. PTILONORHYNCHUS VIOLACEUS, *Vieillot.* Satin Bower-bird.

Ptilonorhynchus violosericeus, Gould, Bds. Austr., fol. ed., Vol. IV, pl. 10 (1848).

Ptilonorhynchus violaceus, North, Nests and Eggs, Austr. Bds., p. 175, pl. XI, fig. 6 (1889).

The same remarks applies equally to this species as the preceding one.

143. CHLAMYDODERA MACULATA, *Gould.* Spotted Bower-bird, Pink-naped Bower-bird.

Chlamydodera maculata, Gould, Bds. Austr., fol. ed., Vol. IV, pl. 8 (1848); North, Nests and Eggs, Austr. Bds., p. 178, pl. XI, fig. 5 (1889).

This species frequents chiefly the scrubby arid country of central and western New South Wales. It is equally destructive to fruits of all kinds, as is the Satin Bower-bird.

144. SERICULUS MELINUS, *Latham.* Regent Bower-bird.

Sericulus chrysocephalus, Gould, Bds. of Austr., fol. ed., Vol. IV, pl. 12 (1848).

A species frequenting chiefly the northern coastal scrubs of the State, the adult male of which is distinguished by its richly contrasted golden-yellow and black plumage. It is common in the Tweed, Richmond, Clarence, and Bellinger Rivers districts, and occurs, but in limited numbers, as far south as the Hawkesbury River. Its usual food consists of insects, berries, and wild fruits, but it is also fond of cultivated fruits.

145. SPHECOTHERES MAXILLARIS, *Latham.* Fig-bird, "Mulberry-bird," "Red-eye."

Sphecotheres australis, Gould, Bds. Austr., fol. ed., Vol. IV, pl. 15 (1848); North, Nests and Eggs, Austr. Bds., p. 185, pl. XI, fig. 77 (1889).

A species also frequenting the northern coastal scrubs of the State, but not occurring so far south as the Regent Bower-bird. Commits great havoc among the softer cultivated fruits, hence its vernacular names of "Fig-bird" and "Mulberry-bird."

146. PTILOTIS LEWINII, *Swainson.* Lewin's Honey-eater.

Ptilotis chrysotis, Gould, Bds. Austr., fol. ed., Vol. IV, pl. 32 (1848).

Ptilotis lewinii, North, Nests and Eggs, Austr. Bds., p. 199, pl. XIII, fig. 1 (1889).

Common in the coastal scrubs and mountain ranges of eastern New South Wales. Like all the members of the family *Meliphagidæ*, its food consists principally of insects and the pollen or nectar of flowers. It is also a fruit-eater.

147. PTILOTIS CHRYSOPS, *Latham.* Yellow-faced Honey-eater, "Chickup."

Ptilotis chrysops, Gould, Bds. Austr., fol. ed., Vol. IV, pl. 45 (1848); North, Nests and Eggs, Austr. Bds., p. 207 (1889).

Common all over New South Wales, and very destructive to most cultivated fruits, and is credited with eating bees.

148. PTILOTIS FUSCA, *Gould.* Fuscous Honey-eater.

Ptilotis fusca, Gould, Bds. Austr., fol. ed., Vol. IV, pl. 44 (1848); North, Nests and Eggs, Austr. Bds., p. 206 (1889).

Freely distributed over the State. It frequents orchards and vineyards, and sometimes eats grapes and cherries, but it is not so mischievous as the preceding species.

149. MYZANTHA GARRULA, *Latham.* Garrulous Honey-eater, "Soldier-bird"; Miner, "Yellow-beak."

Myzantha garrula, Gould, Bds. Austr., fol. ed., Vol. IV, pl. 76 (1848); North, Nests and Eggs, Austr. Bds., p. 229, pl. XII, fig. 2 (1889).

A common and well-known species found over most parts of eastern and central New South Wales. It commits great ravages in orchards and vineyards.

150. MELIPHAGA PHRYGIA, *Latham*. Warty-faced Honey-eater, Mock Regent-bird.

Zanthomyza phrygia, Gould, Bds. Austr., fol. ed., Vol. IV, pl. 48 (1848).
Meliphaga phrygia, North, Nests and Eggs, Austr. Bds., p. 210, pl. XII, fig. 8.

Like many other members of the *Meliphagidæ*, the food of this species consists chiefly of insects and the nectar of flowers, but it is also very destructive to cultivated fruits, and has a decided weakness for figs and grapes. Gould has beautifully figured this showy and attractive species, but the position of the nest is misleading; it is always well concealed by the thick forked limb in which it is built.

151. TROPIDORHYNCHUS CORNICULATUS, *Latham*. Friar-bird, "Leather-head."

Tropidorhynchus corniculatus, Gould, Bds. Austr., fol. ed., Vol. IV, pl. 58 (1848); North, Nests and Eggs, Austr. Bds., p. 217) 1889).

Equally destructive to fruit of all kinds as the preceding species. Although the Leather-head is partially insectivorous, it is a perfect scourge in some seasons to viticulturists. Generally it is most destructive to the summer fruits.

152. TROPIDORHYNCHUS CITREOGULARIS, *Gould*. Yellow-throated Leather-head.

Tropidorhynchus citreogularis, Gould, Bds. Austr., fol. ed., Vol. IV, pl. 60 (1848).
Philemon citreogularis, North, Nests and Eggs, Austr. Bds., p. 219, pl. XII, fig. 3 (1889).

A smaller species than the preceding one, frequenting the inland districts of the State. The vernacular name is only applicable to the young and immature birds of this species.

153. ENTOMYZA CYANOTIS, *Swainson*. Blue-faced Honey-eater.

Entomyza cyanotis, Gould, Bds. Austr., fol. ed., Vol. IV, pl. 68 (1848); North, Nests and Eggs, Austr. Bds., p. 223, pl. XII, fig. 1 (1889).

The Blue-faced Honey-eater is more freely distributed inland than near the coast. Its food consists of insects and nectar, obtained principally from the flowering Eucalypti; and to which diet is frequently added cultivated fruits of various kinds.

154. PLECTORHYNCHUS LANCEOLATUS, *Gould*. Lanceolated Honey-eater.

Plectorhyncha lanceolata, Gould, Bds. Austr., fol. ed., Vol. IV, pl. 47 (1848); North, Nests and Eggs, Austr. Bds., p. 209, pl. XIII, fig. 2 (1889).

This species is only found in the inland districts of the State. During the month of March small flocks of this species of Honey-eater commit great ravages in the vineyards in the neighbourhood of Wagga, piercing and destroying many grapes with their spine-like bills.

155. ANTHOCHÆRA CARUNCULATA, *Latham.* Wattled Honey-eater, "Gill-bird," "Wattle-bird."

Anthochæra carunculata, Gould, Bds. Austr., fol. ed., Vol. IV, pl. 55 (1848); North, Nests and Eggs, Austr. Bds., p. 215 (1889).

A common and well-known species frequenting the coastal districts near Sydney during the late autumn and early winter months, and breeding freely in spring in the Blue Mountains. In the gardens on the mountains it is very destructive in January and February in dry seasons, and does much damage among plums and apricots, and later on about Albury and Goulburn in the vineyards.

About thirty species of Honey-eaters are found in New South Wales, and many of them live entirely upon insects and the nectar or pollen of flowers. Doubtless there are other members of the family *Meliphagidæ* destructive to fruit, but only those most frequently met with in orchards or vineyards are enumerated here.

156. ZOSTEROPS DORSALIS, *Latham* (*Z. westernensis*, QUOY ET GAIMARD). Grey-backed Zosterops, "Silver Eye," "White Eye."

Zosterops dorsalis, Gould, Bds. Austr., fol. ed., Vol. IV, pl. 81 (1848). (*Autumn and Winter plumage.*)

Dacnis westernensis, Quoy et Gaim. Voy de l'Astrol. I, p. 215, pl. 11, fig. 4 (1830). (*Spring and Summer plumage.*)

Zosterops cærulescens, North, Nests and Eggs, Austr. Bds., p. 233 (1889) id. Rec. Austr. Mus., Vol. II, p. 98 (1896).

Zosterops westernensis, North, Nests and Eggs, Austr. Bds., p. 234 (1889).

The "Silver Eye," which varies so much in its summer and winter phases of plumage, is probably known to every orchardist and viticulturist in the State. Although partially insectivorous and ridding fruit trees and shrubs of many injurious insect-pests, it does an immense amount of damage to grapes and soft fruits.

157. CACATUA GALERITA, *Latham.* Sulphur-crested Cockatoo, White Cockatoo.

Cacatua galerita, Gould, Bds. Austr., fol. ed, Vol. V, pl. 1 (1848); North, Nests and Eggs, Austr. Bds., p. 250 (1889).

Most of the different species of the genus *Cacatua*, also the Parrakeets and the Lorikeets, inhabiting New South Wales are either destructive to grain or fruit, both in some instances; but only those most frequently met with, on farms and orchards, of the large Family *Psittacidæ* are referred to here. The present species, which is found in favourable situations all over the State, feeds upon seeds and suturous roots, and on the Native Bread or Truffle (*Mylitta australis*), which it digs up with its powerful bill. Immense flocks of these birds also do considerable damage both to newly-sown and standing grain-crops.

158. APROSMICTUS CYANOPYGIUS, *Vieillot.* King Lory, "King Parrot."

Aprosmictus scapulatus, Gould, Bds. Austr., fol. ed., Vol. v, pl. 17 (1848); North, Nests and Eggs, Austr. Bds., p. 255 (1889).

Common in the coastal districts and contiguous mountain ranges of the State. Very destructive to maize crops, and has been known to eat exposed portions of potatoes.

159. PLATYCERCUS EXIMIUS, *Shaw.* Rosehill Parrakeet, "Rosella."

Platycercus eximius, Gould, Bds. Austr., fol. ed., Vol. v, pl. 27 (1848); North, Nests and Eggs, Austr. Bds., p. 258 (1889).

The well-known Rosehill Parrakeet, or "Rosella," as it is more frequently called, is distributed in favourable situations over the greater portion of New South Wales; it is far more common in the coastal districts, and is not found in the dry western portions of the State. In addition to its grain-eating proclivities, it is very destructive to most kinds of soft cultivated fruits.

160. PLATYCERCUS ELEGANS, *Gmelin.* Pennant's Parrakeet, "Red Lory," "Lowry."

Platycercus pennantii, Gould, Bds. Austr., fol. ed., Vol. v, pl. 23 (1848); North, Nests and Eggs, Austr. Bds., p. 257 (1889).

An equally common species as the preceding, and frequenting the same situations. A notorious orchard marauder, and very destructive in grain crops, particularly when the young maize is just formed in the cobs.

161. TRICHOGLOSSUS CONCINNUS, *Shaw.* Musk Lorikeet, "Green Parrakeet," "Red-eared Parrakeet."

Trichoglossus concinnus, Gould, Bds. Austr., fol. ed., Vol. v, pl. 52 (1848).
Glossopsitta australis, North, Nests and Eggs, Austr. Bds., p. 268 (1889).

During the months of January to April inclusive, in some seasons, the Musk Lorikeet is the most destructive member of the Family *Psittacidæ* in orchards and vineyards of the coastal districts of the State. Countless numbers will devastate an entire fruit crop, and leave not a vestige of it to be seen. So tame are they when so engaged that repeated shooting does not frighten them, and they may be killed with a stick or taken by the hand. Associated with them, but in limited numbers, may also be seen Swainson's Lorikeet, the Scaly-breasted Lorikeet, and the Little Lorikeet. Fortunately these visitations are not of common occurrence, and they generally follow destructive bush-fires, which destroy the flowering *Eucalypti*, whose nectar form a great portion of its food. Stomach of these birds obtained while feeding among the gum blossoms, I have frequently noted, contained the remains of small black beetles.

(Conclusion.)

Brisbane Show Notes.

M. A. O'CALLAGHAN.

THE Agricultural Exhibition held recently at Brisbane was remarkable for two things, viz. :—(1) Its varied, abundant, and excellent display of farm products under the heading of District and Interstate Exhibits. (2) Its excellent display of dairy cattle—more particularly of Ayrshires and Jerseys. If I might add a third feature of note, it would be the admirable manner in which the judging of the cattle and horses was facilitated by arrangements made almost perfect by the untiring and finished work of the ring stewards.

"Speculation of Whitehall" (imp.).

The cattle are judged on the first day in a part of the main ground or ring, there being few horses present, and no one save the stewards and those leading the cattle are within speaking distance of the judges. This is as it should be. The judging of the miscellaneous horses and hunters begins on the second day, and the horses might be said to hold the ring during the remaining days of the exhibition.

Harking back to the cattle! Most people spoke of the excellent display made by the Jerseys, but what impressed me most was the character and quality of the Ayrshire bulls. In the class for three and under four years there were three imported bulls which stood out for type and character, and they will no doubt prove of very great value to the State of Queensland. Two of these were placed first and third, being separated by a New South Wales bred bull of great substance.

The winner of the blue ribbon, who afterwards won the championship, fills the eye very well, has a typical head and horn, but is rather short in the neck and slightly coarse in the shoulder. He has great depth, and his ribs are well sprung. His colour and skin are excellent. I give his colour as brown and cream rather than brown and white. He is good behind, but not so good as the third prize animal, and though of good bone is a bit deficient in his hocks. His tail is well set on for an Ayrshire, and hangs well. He is an animal that, like Jamie of Oakbank, shows himself all the time as though proud of the figure he cuts. He was bred by Mr. H. Smith, Ochiltree, Scotland, is named "Speculation of Whitehall," and is owned by the Queensland Government, being stationed at Gatton Agricultural College.

Another Government institution owns the third prize bull "Ardgowan King Fritz" (imp.), by "Duke King of Ardgowan," from "Louise of Ardgowan," bred by Sir W. R. Shaw Stewart, Bart., Ardgowan, Scotland. This animal, though nearly as old as the champion, is still not so matured from the point of view of a sire. He is of the long reachy type that does not ripen so quickly as the thick cobby sort. His head, neck, and shoulders are well-nigh perfect, and he is undoubtedly better here than the champion. He is, however, not quite so good in the middle-piece nor so deep as the winner. He is very good behind, with a first-class escutcheon and well-placed false teats. His thigh and hindquarter are good, and when another year older, all going well, he will be a very hard bull to beat. He should get good milkers. He still carries his Scotch coat, which is rather longer and coarser than some like to see on dairy cattle. His skin is very good, and his colour is the popular red and white.

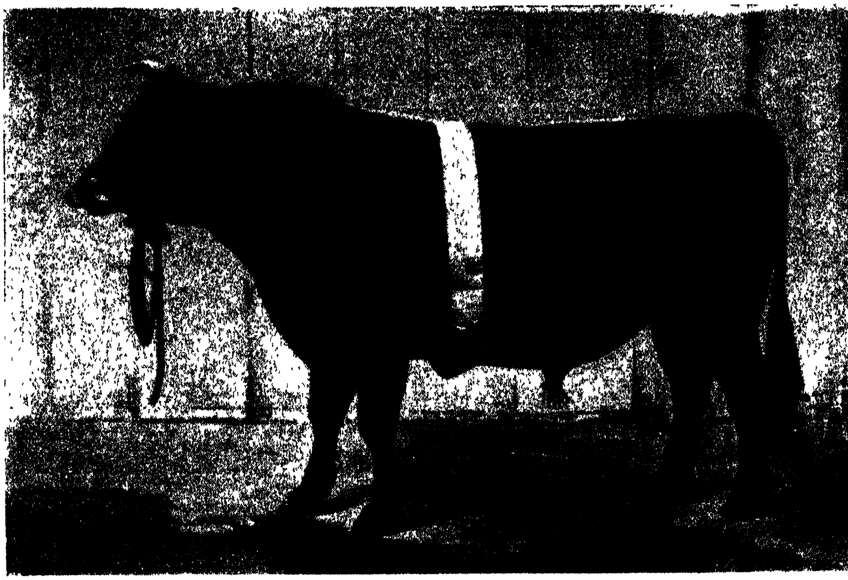
Mr. John H. Brown, Brisbane, also exhibited an imported bull in this class named "Wigton Boy," bred by Messrs. Lindsay, Carsegowan, Wigtown, Scotland. He is a bull of considerable quality, with an excellent head and neck, but lacking in substance. He does not appear to be acclimatised, and later on, if his constitution develops, I expect to see a very nice breedy animal.

In the two-year-old class Mr. J. McWhirter showed an imported bull of type and character, but evidently he has not yet become sufficiently acclimatised to do himself justice, as he lacked condition and polish. This bull is named "Forest Chief," and was bred by Mr. John Cochrane, Kilmarnock. His colour is white and dark-brown. He won in his class.

In the young bull classes the Government institutions above named owned nearly all the animals entered.

Jerseys.

This breed was well represented in all classes, and the champion male and female would do credit to any show-ring. Both are imported



"**King Lear**" (imp.).

"**Grasfort Queen**" (imp.).

animals. The bull, "King Lear," by "Helena's Fox" (3208 I.H.B.), from "Goneril" (7595 I.H.B.), is a typical Island Jersey of great quality

and type. His carriage could not well be better, and he looks what he is—a bull of very aristocratic lineage. He has "Flying Fox" for one of his grand sires, and away back the celebrated "Golden Lad" (1242). He was bred by Mr. C. Mourant, St. Saviour, Jersey. This bull is very good on top, has an excellent head perfectly set on, but is yet rather light in the middle-piece and lacking in that great depth which we wish to see in our dairy cattle, no matter what the breed. He is, however, young, and no doubt will fill out into a deeper-bodied animal.

The champion cow, owned by Mr. O'Shea, Brisbane, is the type our dairy-cattle breeders love. She is of the great depth and substance which goes with a vigorous constitution. She is a rich golden fawn, carrying all the polish of good health and grooming. She was bred by Mr. G. S. Le Gresley, St. Martin, Jersey, and is named "Grasfort Queen" (9455 J.H.B.). She has a typical head, but is somewhat baggy about the throat,

Group of Jerseys at Brisbane Show.
Imported by Mr. J. McWhirter.

and appears slightly heavy in front, but being in high condition this may disappear later.

The group of Jerseys, imported by Mr. McWhirter, seen in the illustration contains the champion Jersey bull and a first-prize cow and heifer. The heifer is a remarkably fine animal, and, all going well, should make a champion.

Guernseys.

Four Guernseys were shown in Brisbane, two of whom had only been recently imported, and two of whom had been bred by the New South Wales Department of Agriculture. Quality was well represented, but it is unfortunate that very fine sire The Apostle, by Peter (imp.), has lost his horns, because it destroys his chance of a show career.

New South Wales dairy farmers will see that our Queensland friends have taken up the question of breeding dairy cattle very seriously, and these recent importations should go far towards placing them in a position to successfully compete with the southern States in the future.

Queensland Nut.

Macadamia ternifolia, F. v. Müeller.

W. J. ALLEN.

In quite a number of the gardens in the coastal districts of the north eastern portion of the State may be found a few of these nut trees growing, particularly on the northern rivers, where the tree does remarkably well on

Fig. 1.--Queensland Nut (*Macadamia ternifolia*), F.v.M.

the deep rich soils and where there are no severe frosts to check its growth.

Baron von Müeller's description of it is as follows:—"The nut tree of sub-tropical Eastern Australia, attaining a height of 60 feet; hardy as far

south as Melbourne; in forest-valleys probably of fair celerity of growth; endures slight frost. In favourable localities it bears fruit in seven years. The nuts have the taste of hazels."

Fuller, on Nut Culture, gives the following description:—"Australian Hazel-nut, the fruit of *Macadamia ternifolia (Proteaceæ)*. There are two species, both evergreen trees or tall shrubs confined to Eastern Australia The fruit is a kind of drupe with a fleshy exterior, enclosing a hard shell nut not unlike a small walnut. The kernel when mature, has a rich and agreeable flavour, much like, but richer than the hazelnut, hence one of its local names for it is also known as the 'Queensland Nut.'"

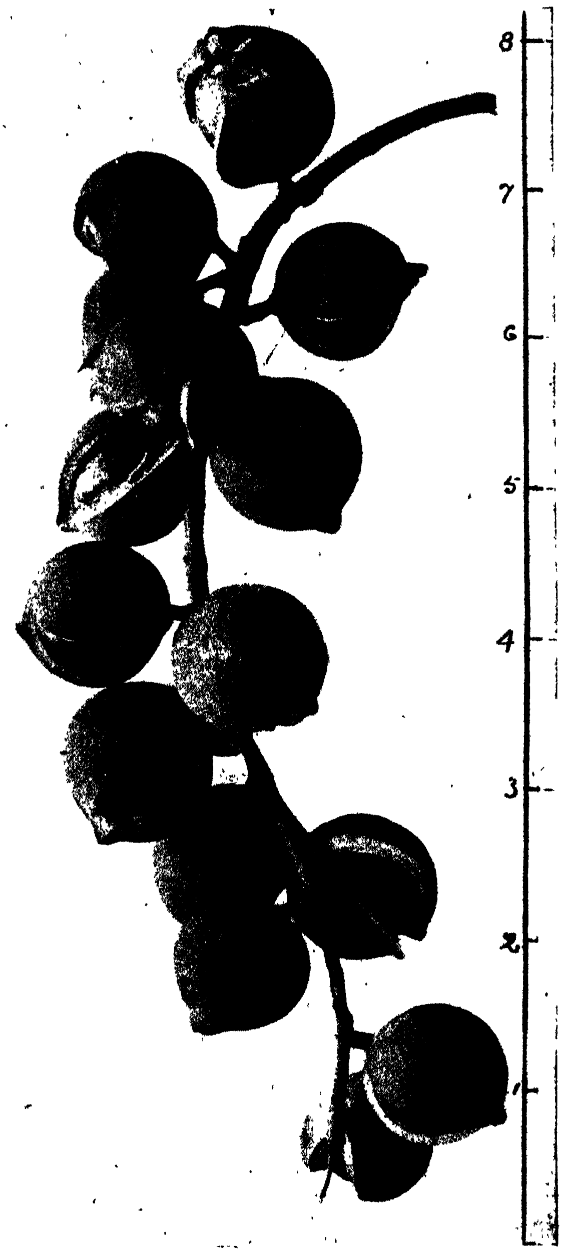


Fig. 2.—Queensland Nut, showing how the nuts hang.

At the Wollongbar Farm there are several trees growing and doing well, and producing some good nuts. Mr. G. L. Austin, of Rous Mill, within a few miles of the farm, has over an acre of these nuts, which are doing well with him, and which prove themselves very profitable, finding ready sale for them at from 6d. to 7d. per lb. The nuts retail in the Sydney fruit shops at 1s. per lb., and are very well liked when they become known. At present the supply in our own State cannot be anything like equal to the demand, and it seems to me that if these nuts were produced in quantities, we should be able to find a ready sale for large supplies in Great Britain and America. The tree is rather slow growing in habit, and does not produce many nuts

until after it has been planted from six to nine years, but after that it usually carries fair crops, increasing in quantity until the tree attains a good size.

Fig. I.—The tree shown is one growing in the garden of Mr. James Inglis, at Strathfield, and produces a good many nuts annually.

Fig. II.—Shows how the nuts hang. Sometimes only one or two are hanging on the one twig, and from that up to twenty-five nuts will be found.

Fig. III.—Shows the nut in different stages. Nut No. 1, with the husk before it begins to open; No. 2 is just beginning to open; No. 3 with the

Fig. 3.—Queensland Nut, showing different stages of growth.

husk off; No. 4 shows the shell broken in halves and disclosing both kernel and shell, which latter is very hard and difficult to break; No. 5 is a kernel with the shell removed. These are all natural size.

This is one of the best flavoured nuts on the market, and I would recommend all those who have not tasted them to buy a few and try them, and also to plant a few trees, or a number, if they are situated close to the coast and have good deep soil, which appears to suit them best.

A few Notes on Grasses.

C. H. GORMAN.

Kangaroo Grass (*Anthistiria ciliata*).

THIS is a grass that is well known all over the State as an excellent fattening grass, and may be considered among the best for the purpose. There are thousands of acres of it around the Casino district, where it

Kangaroo Grass.

grows to great advantage. There it is also used as a dairying fodder, but its value as a milk producer is not very great. It is hardy and strong in growth, a deep rooter, grows tussocky and erect. It grows luxuriantly from October or November, and makes hay of fair quality.

Guinea Grass (*Panicum maximum*).

THIS is certainly one of the most valuable grasses that can be grown for fodder purposes, and the wonder is that more serious attention is not directed towards it. Many reports have been made on the grass and its value, and it seems like pegging away for nothing to write on it again. The results are apparent, both from trials on this and private farms. Some years back Mr. McKeown, now Manager at Wagga Farm, cut

Guinea Grass.

19 tons 6 cwt. per acre. A glance at the illustration will show the great amount of succulent matter produced. Its cultivation is easy, and 1 or 2 acres of it for feeding in either green or preserved form will warrant all trouble and expense gone to. It is safe to say that it is quite out of the experimental stage now. Stock are very fond if it, and its greatest fault lies in the fact that it will not stand frost. As a summer grass, it is a wonderful grower, and makes excellent hay.

Natal Red Top (*Tricholæna rosea*).

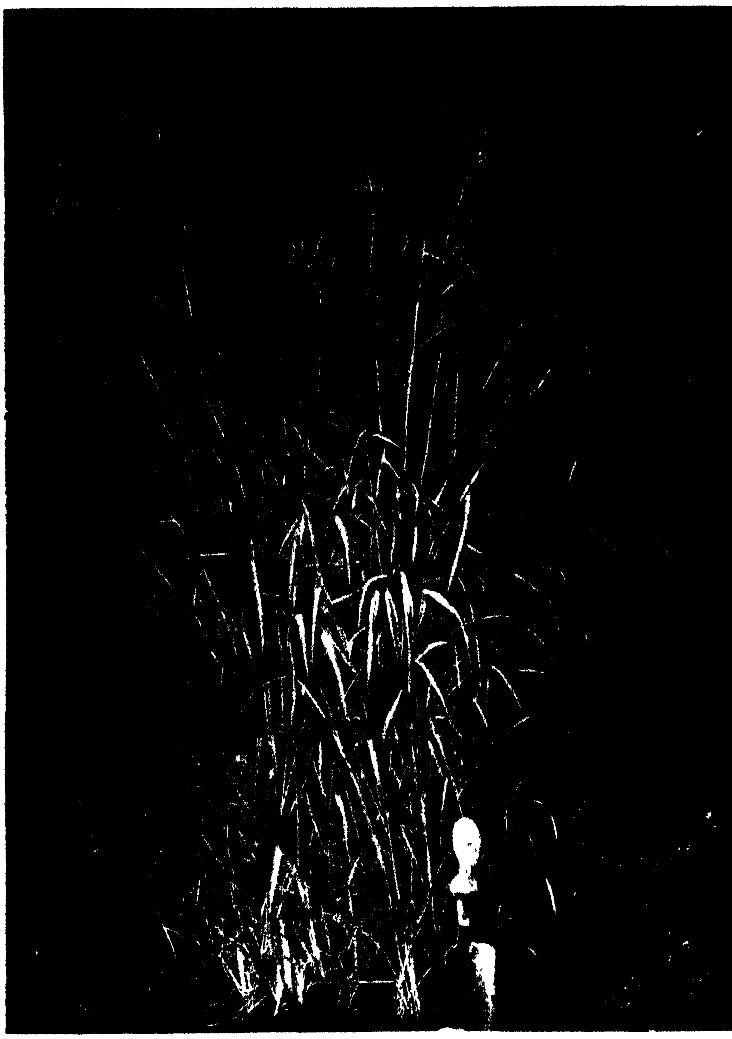
THIS is an extremely useful grass in combination with other varieties of a heavier nature. Its habit of growth is upright, and it bears the virtue of being a quick spreader. In its young state it is most palatable to

Natal Red Top.

stock, and can be converted into hay with good results. It is looked upon as a good grass for young stock, and grows luxuriantly in this district.

Rhodes Grass (*Chloris virgata*).

So much has been written about this grass that it should be well known to all interested in the introduction and propagation of useful varieties. It was introduced from South Africa, and given trials by a number of graziers and others, Mr. Sylvester Browne being the first to bring it prominently forward. Trials have been carried on at this farm for two years now, from a very small quantity of seed sent to the Director



Rhodes Grass.

of Agriculture by Colonel Kenneth Mackay, who brought it from South Africa. From the outset it grew well, and larger areas have now been set out, with every prospect of success. I have always considered it a good grass, and worthy of trial by those interested. The introduction of new grasses is sometimes the cause of much discussion of a con-

ANTHISTIRIA CILIATA, Linn
"Kangaroo Grass"

troversial nature, and I have heard many say that "Rhodes" grass is no good. My opinion is that it will be found of great value, and I think it a little early to condemn the grass just because it has not shown itself as luxuriant a grower as, for instance, *Paspalum dilatatum.* When the latter was introduced, it was condemned too early by some, but it has proved itself beyond doubt. "Rhodes" grass is about in the same position as *Paspalum dilatatum* as regards frost resistance. It will stand a fair amount, but is cut down by a severe frost. There is no indication, however, of it being killed outright—merely a burning off, as in the case of other grasses.

REFERENCE TO PLATE.

A, Cluster of spikelets; B, Barren and fertile spikelets; C, The fertile terminal spikelet opened out to show the three glumes and awn; D, Grain, back and front views. All variously magnified.

(To be continued.)

BIRD-LIME FOR SPARROWS.

THE bird-lime may be spread on twigs placed near food or water. In the latter case, it is all the more likely to succeed where water is scarce.

We have tried it here (Hawkesbury Agricultural College), and the sparrows are just as cunning in keeping clear as is the case with poisoned grain.

If a decoy sparrow can be placed near by there will be more chance of success.

It has also been found that narrow strips of paper smeared with this substance, if placed where they can touch one, will prevent them getting away. The paper should be dark and strong.

If such a plan is tried, the trap should be placed in as natural a way as possible so as not to frighten the bird.

One trouble is, that it is necessary for someone to be near at hand to take the birds if they are caught, as they are strong and quite likely to break away from the retaining twigs if they are allowed any time to struggle about.

Any chemist can obtain the substance wholesale. It is about 3s. per lb.

C. T. MUSSON.

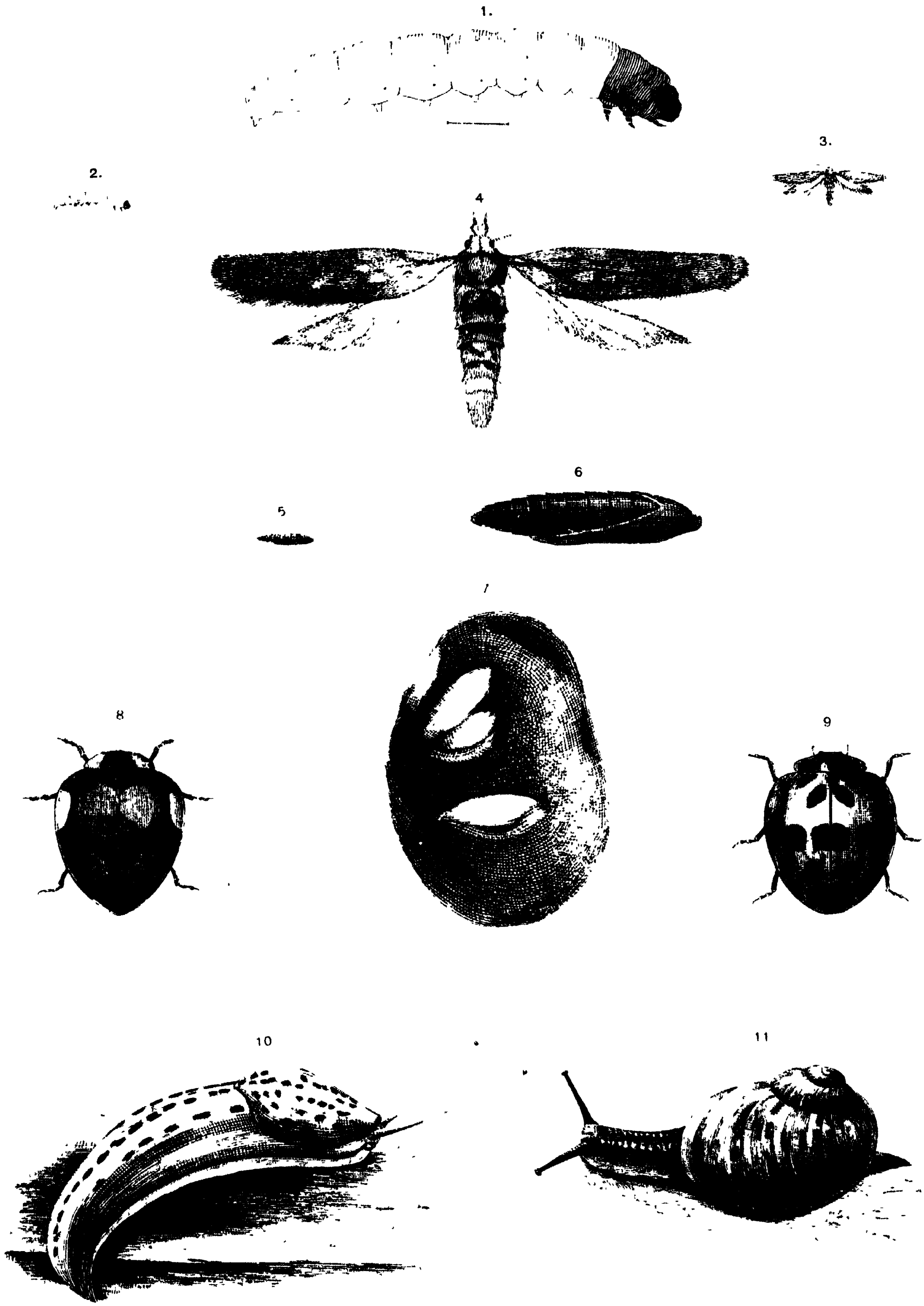
The Farmer's Garden and its Enemies.

WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

It is a very poor farmer who has not a plot of ground somewhere about the place that he calls his garden, but while one often finds one worthy of the name of garden, properly fenced, well kept, well tilled, without weeds or rubbish cumbering the beds and paths, and everything flourishing, how often do we come across the reverse. A few decrepit rails and slack wires are the only protection against the pigs and poultry; the family calf may be tethered in the middle of it, the beds full of cabbage stalks covered with shoots infested with aphis, with decayed full-grown plants left over from last cutting, a home for all kinds of garden pests, ready to pounce upon the young plants that later on will be planted out beside them. The tomato beds are much the same, the old plants broken down and frost-bitten, with fruit in all stages of decay hanging to their withered stalks or littering the ground beneath.

It is remarkable how little attention is paid to "garden truck" as the Americans call it, though such an important factor in the food supply of the homestead. Even in districts like Campbelltown it is quite a common sight to see the Chinaman with his vegetable cart calling at the orchardist's house, where there is unlimited ground fit to supply all his wants. How many farmers are growing their own potatoes at the present time, and what does it cost them to buy them? Now, without going into the matter of gardens that abound in plague spots or otherwise, there are always a certain number of pests of many different kinds to contend with, and in this paper I propose to group them together and give a simple account of each and how best to check or get rid of them.

Many fungus diseases also abound in gardens and require different treatment; powdery mildews that wrinkles up the leaves and causes the flower-buds to become aborted and drop off, can be best checked by dusting with sulphur, and the kitchen flour dredger is one of the best implements to use for this work. Other spots and moulds on the leaves and stems can be usually kept under by using a solution of bluestone in a garden syringe. If all dead leaves about the plants are cleared away, great numbers of the tiny spores are destroyed, which otherwise multiply in countless millions, float about in the air, fall upon any scar or wound on the healthy plants, infect them, and carry disease all over the place. The natural tendency of all old leaves and stalks of a plant is to decay, and when this commences, spores and germs of all kinds are liberated, therefore if all such matter is removed the garden crops have a much better chance of doing well.



FARMERS' GARDEN PESTS.

1. *Caterpillar -Side View enlarged.*
2. ,, *Natural Size.*
3. *Moth—* ,,
4. ,, *Enlarged*
5 *Pupa -Natural Size.*
6. *Pupa -Enlarged*
7. *Potato, with Cocoons attached*
8. *The Potato-leaf Ladybird.*
9. *The Twenty-eight Spot Ladybird*
10. *Garden Slug*
11. *Garden Snail*

Snails and Slugs.

Old gardens in particular are often so overrun with these introduced pests that it is difficult to rear any small plants or seedlings; and the simple way in which they can be carried about in packing or plants makes them world wide in their distribution.

After a spell of long-continued dry weather, let us get a wet night and out swarm these creatures from crevices and corners in which they have been sheltering. This is the time to go out with a tin of salt and water, and gather them in; and in a small plot, if this method is followed up, it is wonderful how quickly you can reduce their numbers. A second method, most effective with the naked black slugs, is to rub dripping over the underside of well-grown cabbage leaves, and lay them about among the plants. This bait seems to have a great attraction for all kinds of slugs, and they gather together from all sides to feast on the grease, when they can be collected and destroyed. As a protection against snails, however, there is nothing like tobacco dust. A little ring of waste tobacco dust will protect the most delicate seedling; for as soon as a snail or slug crawls on to the tobacco, it simply turns over, with its foot slimy and frothy, and is incapable of motion, dying a victim to tobacco poisoning.

Millipedes (False Wire-worms).

These are not true insects, as they consist of a small head, with a worm-like body of many joints or segments, each furnished with a pair of fine legs, which, when they crawl over a smooth surface, move with an undulating motion. They are, when immature, dull white; many species grow to 1½ to 2 inches in length; they frequent damp, sheltered places.

In England they are known as "False Wire-worms," and at times do a great deal of damage by devouring germinating seeds, and also by eating the soft, juicy parts of turnips, carrots, and such like vegetable matter. This season they have, in consequence of the wet season in the country, turned up in both gardens and lucerne paddocks, in the latter attacking the young plants. To keep these pests from the seedlings, bits of potatoes are placed about among the rows.

The Pumpkin Beetle (Aulacophora hilaris).

This is one of the worst leaf-eating beetles that the gardener has to deal with, as they often appear in such numbers that they simply cover the leaves and flowers, and, if undisturbed, will soon destroy all the pumpkin and cucumber plants in the place, even after they are well grown.

It is a small, orange-yellow beetle, with the body marked with two rows of black spots; and though often called a "ladybird," is a very different insect to the true ladybird beetles, which are more rounded in form, without any neck-like thorax between the head and body. It is simply a case of mistaken identity, on account of a similarity of colour.

Though this beetle has been well-known for a great number of years, we know nothing about its earlier stages of life, though most of the plant-eating

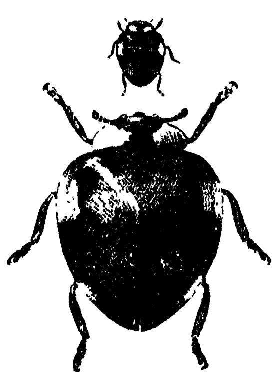
beetles usually have larvæ with the same habits. If the pumpkin plants are well dusted with lime all over the flowers and foliage, the beetles will leave them at once.

Plant-eating Ladybird Beetles (Epilachna 28 punctata.)

This beetle belongs to a small group of the ladybirds which are remarkable for feeding upon the foliage of plants, unlike all the other members of the family that devour aphis scale and other minute pests.

Epilachna 28 punctata.

This beetle might at first sight be easily mistaken for our black spotted ladybird (*Leis conformis*) a great enemy to aphis and scale insects, but the shoulders are more curved in behind the head, the yellow ground colour has a dull brownish tint, and the black markings not in such regular rows, so that it has five rows instead of four. The larvæ are very different looking dull yellow-coloured creatures, clothed with rows of branched black spines, are gregarious in their habits, and when pupating cluster together on the under-surface of the leaves. This beetle infests various kinds of solaniums in its native state, and when it appears in gardens attacks the foliage of potatoes and tomatoes.



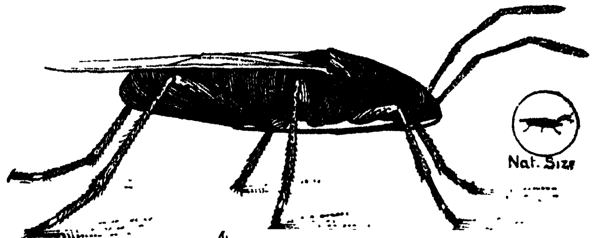
Epilachna guttato-pustulata.

The second species, which is more confined to the northern part of the State (*Epilachna guttato-pustulata*) is a much handsomer beetle, about the same size and shape, reddish-brown, with black markings on thorax and wing covers, dull-red blotches in the centre, and the sides blotched with lighter yellow. It has the same habits, and in southern Queensland is a common insect in the bush and gardens. They are easily driven away in the beetle state by dusting the plants with lime.

The Rutherglen Bug (Nysius vinitor).

This little plant-bug is a light-brown insect with silvery-grey wings, measuring about one-sixth of an inch in length. They fly very well, and in the warmer part of the day are very active, while during the night and morning they cluster among the foliage sucking up the sap with their sharp beaks, and soon causing the plants to shrivel up and die. They are particularly fond of tomato and potato plants, though they infest many other plants and trees. They appear in the summer from the eggs that have been deposited on the grass stalks and weeds by the last brood. It is very little use spraying the plants to kill the bugs, as they always shelter under the foliage, or fly at the least alarm. The best method to rid the plants is to take a shallow dish or tray containing a mixture of water and kerosene in the early morning, and

drawing it down along the plants, beat the foliage over with an old broom or cloth, when the insects will fall and be smothered very easily. A simple sheet can be drawn along in the same way, and the bugs gathered up and destroyed.



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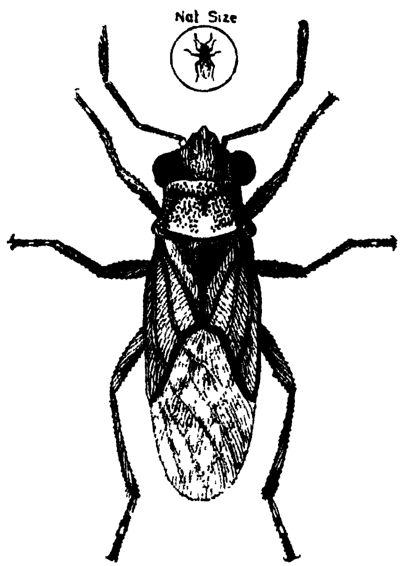
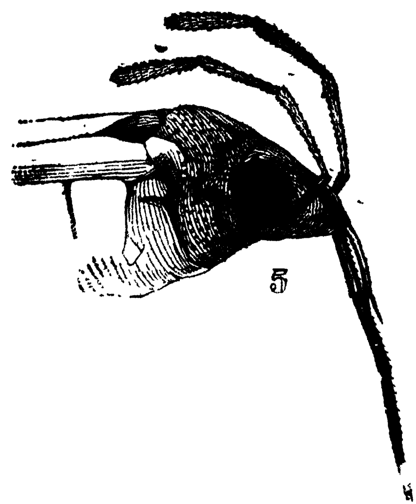
Nysius vinitor.



Nysius vinitor.



Head of Nysius vinitor.

The Common Cut-worm (Heliothis armigera).

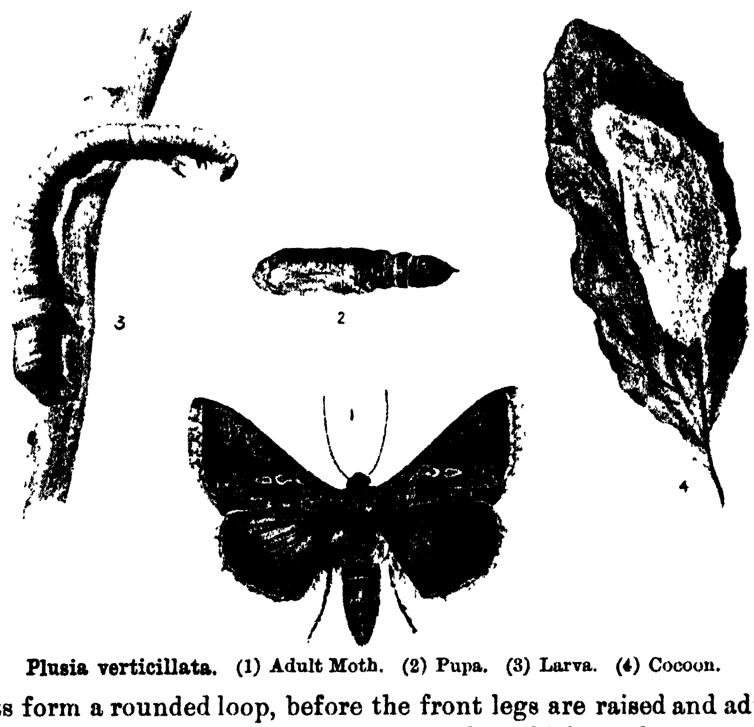
Though quite a number of different moth-grubs are known under the popular name of "cut-worms," it is the larvæ of the American boll-worm, now world-wide in its distribution, that is the chief offender. A cotton pest in America, a trouble to maize-growers on the Northern rivers, it is common among our tomatoes, and gets into the pea-pods, devouring the enclosed seeds; while in the open it gnaws off the freshly set out plants, and after eating its fill, buries itself in the soil beneath the scene of its depredations, when it can be easily uncovered and destroyed.

It is of the usual naked cylindrical form, varying from a dirty olive-green tint to pale green, showing a regular pattern on the sides and back. The moth, one of the thick-set night-flying noctuids, laying her eggs among the rubbish or on the plants. The larvæ, when hatched out from the eggs, feed upon the surrounding vegetation, and are not particularly noticeable until fully half-grown. In the daytime they hide under the plants or half-buried

in the soil, so that one of the best ways of collecting them together and destroying them is to pile up a little heap of weeds or leaves on the edge of the path or among the plants under which they will creep for shelter. Poisoning bran or pollard with Paris Green, and spreading it about in teaspoonful's among the infested plants will soon kill them off, as all cut-worms readily eat bran and pollard. It is best mixed with a little water, and each bait half-buried in the surface soil. I have always found it very effective among tomato plants.

The Bean and Potato Looper (Plusia verticillata).

The slender green caterpillar, though the moth is a distinctive noctuid moth, has the form and habits of the looper moth caterpillars ; the legs upon the body segments being placed far back near the tip, so that when crawling along the hind portion is drawn up close behind the head, and the central



Plusia verticillata. (1) Adult Moth. (2) Pupa. (3) Larva. (4) Cocoon.

segments form a rounded loop, before the front legs are raised and advanced. The eggs are deposited by the dull-brown moth—which can be recognised by the silvery markings on the fore wings—upon the foliage, and the delicate green tints of the caterpillar harmonise so exactly with the colour of the leaf, that they are not at all noticeable until they begin to gnaw holes in the leaves. This might be described as the commonest pest upon French beans ; but it also does a great deal of damage to potatoes at times, and was quite a plague on the latter in the Windsor district some years ago. Experiments carried out during that outbreak proved that arsenical sprays did not seem to have much effect on these grubs, probably because it is always difficult to spray the under surface of field crops. Brushing the plant lightly over a sheet or dish caused the grubs to fall in great numbers, when they were easily destroyed, and the pest was kept under.

The Potato Moth (Lita solanella).

Though potatoes can be better looked after in the garden than when they are planted in the fields, this little silvery-brown moth is so widely distributed over the country that it is always on the lookout to deposit its eggs upon these tubers, and is always worst in hot dry years.

Though the moth deposits her eggs upon the foliage of the potato, upon which the first brood of caterpillars feed, it is not until the potatoes are dug up that the second brood of moths have any chance of infesting them. They are safe underground; but as soon as they are dug the moths lay their eggs upon the tubers and the grubs that hatch out soon burrow their way under the skin and soon destroy it;—if they are allowed to lie about in the garden or exposed in open bags they soon show signs of the grub, so that the sooner they are covered up the better. The careful farmer pits his potatoes, or covers them, placed in boxes, with dry sand or ashes, and burns up all the potato tops and rubbish in the garden. A little care will keep the garden potatoes clear of "fly" or moth.

The Diamond-backed Cabbage Moth (Plutella cruciferarum).

If a person takes the precaution to dip all the young cabbage-plants into a bath of weak kerosene-emulsion, or tobacco-wash, before he sets them out, (having buried or otherwise destroyed all the waste and refuse after the cabbages were marketed), unless he happened to be close to a neglectful neighbour's garden, he would have very little trouble with the cabbage moth.

When, however, this moth once gets into the garden plot, it takes a lot of work to clear them out. Many remedies are effective when applied in the earlier stages of the plants' growth—such as spraying with weak kerosene-emulsion, or tobacco-wash; but the nearer the plants reach maturity the more difficult they are to treat, both on account of size and the danger of tainting them with the mixtures used.

The little brown moth is easily distinguished from others by the row of lighter-coloured angular or diamond-shaped marks along the back, when it rests with its wings folded up. It is seldom seen unless the plants are disturbed, but the slender pale-green caterpillars gnawing holes in the leaves and later on the curious net-like cocoon containing the pupæ are very readily detected.

The Cabbage Aphis (Aphis brassica).

When the spring is dry and very little sap is coursing through the veins of the young plants, these aphis generally do the most damage to cauliflower and cabbage, which cannot withstand their attacks under such conditions, and become stunted, wilted, and spoiled.

Later on in the summer in a good season immense swarms of aphis sometimes cover the outer leaves of the plants. This autumn large consignments of cauliflowers crossed the border at Albury from Victorian growers, which, when transhipped into our trucks were simply gray with aphis which, shaken up on the journey, could be shovelled up from the bottom of the empty

truck. I obtained a number of leaves and found nearly every aphid remaining attached to them was simply a shell containing a little wasp parasite (probably the common little braconid *Aphidius rapæ*). As the bulk of the free aphids were more or less damaged before they reached Sydney we probably received as many parasites as aphis.

The wingless cabbage aphis (the form that does the chief damage) is a small greenish-blue insect, covered with a gray meally coating, which assists it to throw off any fluid mixture that may be applied. It has been found that where a good pressure of water with a hose can be used, or even a fine-rosed watering-can, it will help to clean the plants as well as anything, but tobacco and soap wash can be used with good effect in small areas.

Eupatorium rebaudianum, Bertoni.—A Reputed Sugar-producing Plant from Paraguay.

A few months ago paragraphs went the round of the Australian Press drawing attention to the above plant (called in some accounts *E. repandum*, Willd., a different plant). Inquiries were made at the Botanic Gardens for the plant, and as I had not got it I applied to Kew. I have just had reply that it does not even exist in the Kew Herbarium, but the Director of Kew draws my attention to the account of the plant in the *Kew Bulletin* for 1901, p. 173, from which the following interesting particulars are taken :—

Caá-êhê or *azucá-caá.*—Early in the present year, Mr. Cecil Gosling, H.B.M. Consul at Asuncion, Paraguay, sent to Kew a fragmentary specimen of a composite plant, with the following information :—

"I beg to enclose herewith some leaves of a plant which has lately been discovered in Paraguay, by Dr. Bertoni, an Italian botanist, and Director of the Agricultural College here. This plant, which has probably been known to the Indians since a hundred years or more, and whose secret has, as usual, been so faithfully guarded by them, grows in the Highlands of Amambai, and near the source of the river Monday, not being, it is said, found further south than this. It is a modest shrub, growing side by side with the weeds and luxuriant grasses of that district, and only attains a height of a few inches. The leaves are small, and the flowers still more diminutive, and the Indians call it *Caa-êhê*, meaning, sweet herb, because of its sweetness, a few leaves being sufficient to sweeten a strong cup of tea or coffee, giving also a pleasant aromatic flavour. Its discoverer does not, however, believe that the *Caá-êhê* bears any relation to the saccharine properties of sugar, and he has named it after Professor Ovidio Rebaudi, of Asuncion, *Eupatorium rebaudianum*.

In an article describing the plant, Dr. Bertoni remarks, I think with great justice, to what extent we are indebted to those close observers of nature, the Indians, from whom we have learnt the use of tobacco, cocoa, maize, mani, manioc, potatoes, cotton, quinine, vanilla, rubber, and sarsaparilla. Truly a long list of benefits to mankind! I am told also that Dr. Bertoni has lately discovered a tree, whose sap is alcoholic, and similar in taste and colour to a rough red wine, being used as such by the Indians."

Subsequently Mr. Gosling sent a copy of the *Revista de Agronomiá*, ii., pp. 35–37 (1899), where the description is given. There is no doubt that the plant possesses very strongly the power of stimulating the sensation of sweetness, for the smallest piece of a leaf causes a persistent sweetness in the mouth. We have not succeeded in identifying the fragments sent with any plant in the Kew Herbarium, but from the floral structure it belongs to *Stevia*, rather than *Eupatorium*, and its affinity is with *S. collina*, Gard.

J. H. MAIDEN.

Treatment of Snake-bite.

J. ASHBURTON THOMPSON, M.D.,
Chief Medical Officer, President Department of Public Health.

THE following directions for the immediate treatment of persons suffering from Snake-bite are published for general information.

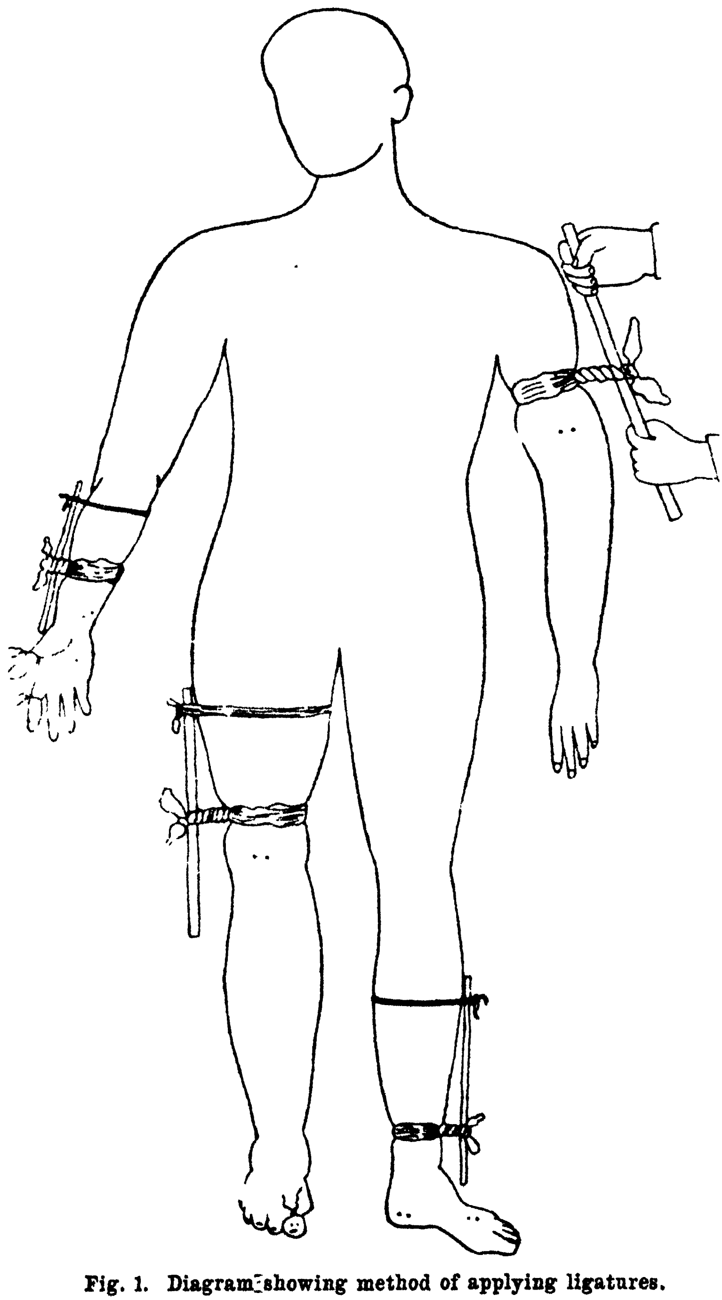


Fig. 1. Diagram showing method of applying ligatures.

Directions.

A Ligature—that is, a strong string, tape, narrow strip of clothing, or handkerchief—should be tied at once round the limb *above* the bitten part. When it has been tied, pass a piece of stick under it, and twist it round and round so as to screw up the ligature as tightly as you can. Leave the stick in the twisted ligature, and secure the end by another string as shown in the Figure (1). Great pain and swelling are caused by this, but cannot be avoided.

At the end of half an hour undo the ligature for five minutes; then tie and screw up again. At the end of another half-hour the ligature may be removed altogether.

In places where a ligature cannot be tied, as on the neck or face, pinch up the bitten part between the finger and thumb, and cut it out (Figure 2).

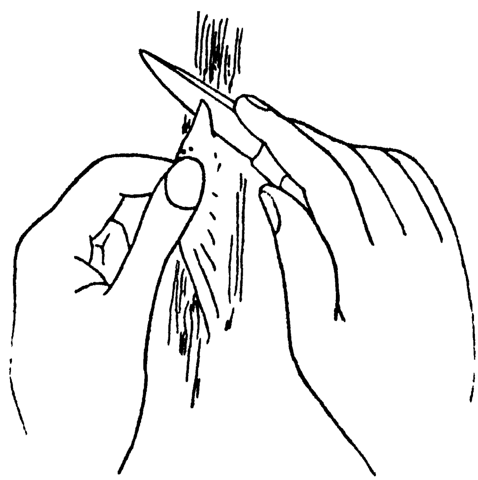


Fig. 2. Diagram showing method of cutting out bitten part.

In any case the bitten part should be cut into by numerous little cuts over and around the bites, for about half an inch around, and sucked by the mouth freely and perseveringly; and this can be done without danger by any person.

Stimulants, such as brandy, whisky, gin, rum, in small quantities at a time (a few teaspoonfuls), or strong tea or coffee, or wine, may be given if the patient be faint.

Do no more to the patient than is advised above, but obtain the services of a medical man.

Orchard Notes.

W. J. ALLEN.

October.

Owing to the dry weather prevailing during the last few months the crops of black tares, grey field-peas, &c., &c., have not made as much growth throughout the Cumberland orchards as they did last year, and if we do not get good falls of rain within the next six weeks the growers may find that the soil has become hard to plough when such crops are in condition for turning under. It is well not to leave them too late before turning them under. At our Wagga orchard, where the crop has been exceedingly heavy this year, most of it will be turned under by the first of October—at least all the most forward portion. At this orchard we dug up and weighed the tares from a plot of a yard square and it went at the rate of 16 tons 15 cwt. to the acre, when green, a fortnight before it was turned under.

The high winds which prevailed during a great part of September were responsible for blowing a good many oranges from the trees, which meant a considerable loss to growers, as owing to the dry, cool weather the fruit was hanging well in most districts the winds, however, and the frosts have caused a great number of wind-falls.

Growers should see that the orchards are cleaned up as early as possible and the soil worked up to a good depth and cleared of all weeds, so that any moisture in the soil may be conserved for the sole use of the trees and fruit.

As soon as the petals have fallen spray the trees with arsenite of soda, directions for mixing which may be found on page 793 of the August *Gazette*, and are as follows :—*Stock solution*—1 lb. of best arsenic and 2 lb. washing soda boiled in 1 gallon of water for about three-quarters of an hour, or until the mixture is quite clear. Then add 1 pint of this stock solution to 40 gallons of water, to which has already been added from 6 to 8 lb. of best freshly-slaked lime. If this latter precaution is neglected the result will be serious damage to the foliage. Some varieties of apples are much more tender than others. For these use the larger quantity of lime. The arsenic is much cheaper than Paris green, and when bought in quantities should not cost more than about one-third as much per lb. For this State I am of opinion that at least four sprayings will be necessary to keep the moth in check.

If it is desired to add bluestone to the arsenite of soda solution, 3 lb. of bluestone may be dissolved in 1 gallon of hot water, and when thoroughly dissolved can be made up to 20 gallons by the addition of more water. Now take 1 pint of the stock solution of arsenite of soda and dilute in 20 gallons of water, in which from 6 to 8 lb. of freshly-slaked lime has been added, and pour this into the bluestone mixture, thus making the whole up to 40 gallons. Strain before using.

In spraying use as fine a nozzle as possible, the object being to cover the tree with as fine a mist as possible without any of the solution running off.

It will be well to get the bandages on the trees towards the latter part of the month, and these should be removed and examined every ten days after the grubs have made their appearance, and all grubs and chrysalids destroyed by cutting them in halves with a sharp knife carried for the purpose.

Keep a strict watch on all refills, and if these show any signs of wilting give them one or two buckets of water from time to time until they get a good start.

Disbud all newly-planted trees, leaving good shoots at least 4 inches apart along the trunk of the tree, and do not allow two or three shoots to start from the same place, as so many have done, but give each branch a separate hold of the main stem.

If the sap is well up, citrus-trees may be successfully budded this month. Keep all dormant buds and grafts well disbudded, so that the bud may get away good and strong. No suckers or shoots should be allowed to grow below the buds. It is also very essential that stocks should be cut back properly. The cut should be slanting, being slightly lower on the side opposite to the bud, and it is advisable to stake them, not only to prevent their being blown out, but to encourage a straight trunk.

Where grafts have been put in old trees they are even more liable to be blown off than small ones, and must be tied to prevent it. To do this a good stake should be tied to the branch grafted and allowed to project a foot or more over the end—then, as the graft grows, it can be tied to it.

While working around trees watch for borers on the trunks and branches, as when they are starting their work it is very easy to cut away the bark and find them, in this way keeping the orchard free of this pest.

As soon as the vines begin to grow sulphur them at least once before blooming for mildew, and twice if the weather is very damp. In coastal districts it is well to spray them immediately after the fruit is set with Bordeaux mixture, and, should caterpillars of any kind be eating the leaves, add Paris green to the solution in the proportion of 1 oz. to 20 gallons. Repeat the sulphuring from time to time, giving as many as eight applications if the season is at all damp. This will pretty well keep the oidium in check.

Keep all vines well disbudded. I have noticed in many small vineyards that this important work is neglected. Never allow any branch to grow below the crown of the vine. To do the work properly it will be necessary to disbud all vines from two to three times.

Price of Kainit.

In a paragraph (August *Gazette*) referring to white ants attacking fruit-trees, vines, roses, &c., Kainit is recommended by Mr. Froggatt, Government Entomologist, but the price therein mentioned is wrong; a recent price-list gives the price of Kainit as 9s. per 2-cwt. sack.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of October.

Vegetables.

At this time of year, unless very dry weather prevails, vegetables should be abundant, and the prospects for the future should be good, until the intense heat of midsummer may check their growth; but even during the hottest weather, if good preparation be made now, there should be some kind of vegetables in abundance.

So far, and up to time of writing, everything is favourable for vegetable production in most of the western districts; but along the sea-board and for some distance inland extraordinary dry weather prevails, necessitating a good deal of trouble in watering, cultivating, and mulching to keep things going. (Rain has since fallen on the coast.)

A manure that is generally allowed to go to waste is soot. This is of considerable value in the vegetable garden, not only as a manure, but as an insecticide, or rather, perhaps, a preventive of attacks of insects. It is supposed to be of use only as a manure, in consequence of the nitrogen it contains, as that is the substance for which it is mostly recommended; but I feel sure that it is of value otherwise. At anyrate, soot should never be wasted, and every ounce, even, that can be scraped together should be made use of for vegetables. Asparagus and onions are much invigorated by an application or two. For these vegetables, it is generally mixed with some salt as a surface dressing.

If water be applied to the surface of the soil, always cultivate well after an application, as soon as dry enough, or else the soil may become hard and caked, and in a condition unfavourable for the growth of vegetables.

Beans, French or Kidney.—Keep up a succession of this kind of bean, which is one of the best of vegetables for summer use. If well grown, and the beans are gathered whilst they are young and tender, the plants will continue to produce beans for a considerable period. Sow from time to time various kinds of these beans, some dwarfs, some tall, one or two kinds of butter beans, scarlet runners, snake beans, and any varieties that are obtainable, and try a few experiments as to productiveness, flavour, endurance, and so on. By this means the best and most suitable variety for locality can be determined, and for the future this can be grown chiefly. But continue to try new varieties, for experimental work of this kind is useful as well as interesting, and tends to break the monotony of ordinary gardening work.

Lima Beans.—These useful beans, either tall-growing and dwarf, should always find a place in the vegetable garden. A few plants are likely to suffice, and these should produce beans for a considerable time. The tall-growing varieties are the most prolific, and are to be preferred.

Beet, Red.—Sow a little seed in drills, about 18 inches apart. If the seed be spread out on damp cloth or bagging, and covered over and kept warm, it will soon swell and germinate. It can then be sown, but the precaution must be taken to water the ground well, so that it becomes thoroughly saturated, after the seed is sown, otherwise the chances are that it wil die—that is, if the soil is dry. Beet-seed sown in the usual manner and unsprouted, takes a long time to germinate and come up, and much time can be saved if the above simple practice is followed. When the young beets have grown to the height of an inch or two, thin them out, for very frequently two or more plants will come up quite close together, and unless separated the results will be unsatisfactory. The globe varieties are the best to grow.

Beet, Silver.—A few plants of this excellent vegetable will probably be sufficient for a family. Seed may be sown in a seed-bed, and when the plants are well grown they can be planted out in a bed which has been heavily manured and well worked.

Cabbage.—Keep up a stock of cabbage as long as possible during the year, for it seems to be appreciated more than any other vegetable except the potato. Try a few varieties, for some kinds may do better than others in various localities. Small cabbages are sometimes much to be preferred to those that grow to an enormous size, although sometimes the latter will be found excellent. One of the best of these is Phenomenal, the seed of which is somewhat difficult to obtain. However, try a few experiments with varieties. Use abundance of manure for the cabbage, and supplement farmyard manure with bone-meal or superphosphates of lime, or apply a good dressing of lime to the soil a little time before digging in the farmyard manure. Spread the lime over the surface of the ground and rake it in. That will be quite sufficient, for lime has a tendency to sink with the soil. This should be remembered when making use of lime for agricultural as well as for gardening purposes. Mr. Krempin, of Newcastle, gave me some seeds of a new cabbage named "Extra Improved Early Summer Cabbage," and I sent it to the Howlong Viticulture Nursery for Mr. Ellis to try. It turned out to be an excellent one, and Mr. Ellis informed me that it is the best cabbage he ever grew, even better than Phenomenal. He describes it as rather low growing and broad, and its texture and flavour to be everything that could be desired.

Cauliflower.—This is not likely to succeed very well in hot, dry districts at this time of the year; but in cool, humid localities a few seeds should be sown and some young cauliflowers planted out.

Carrot.—Always have a few carrots ready for use, if possible, for the carrot is a good useful vegetable, and an excellent one for flavouring made dishes, for soups, &c., and for these purposes the carrots can be

used quite young and small. Land that had been well manured for some other vegetable would be the best to take for the carrot, for fresh manure is liable to cause irregular-shaped roots.

Celery.—This is a very useful vegetable for the summer, and one which is worth taking some little trouble to grow. A few seeds may be sown now to keep up a supply of plants. Seedlings already raised should be pricked out 3 or 4 inches apart, in rich soil, and when these have grown into good plants, they should be set out in a shallow trench which has been heavily manured. During summer celery is liable to "bolt," or run to seed, and when it does so, it may be pulled up as useless. To avoid this as much as possible, keep it growing from start to finish without the slightest check. Remove the seedlings carefully without disturbing their roots more than can be possibly avoided, watering them well before removal and after they are planted. Then never let them suffer the want of water, making use occasionally of liquid manure.

When the celery is about full grown, its leaf-stalks must be blanched, otherwise it will be unfit to eat uncooked. For this object, use may be made of soil, or any material that will keep out the light absolutely. Old bagging, boards, drain-pipes, pea and bean haulm are sometimes used, and effectively. Try the self-blanching kinds, which lend themselves readily to the blanching process. Indeed, these are sometimes planted in beds very close together, and then, when they grow dense, need but little, if any, assistance.

Celeriac, or Turnip-rooted Celery.—This is a kind of celery grown for cooking purposes, for which it is very useful. Sow seed, and transplant well grown seedlings—not to shallow trenches, but on the flat, about 18 inches apart. Keep the plants going by use of abundance of water, and cultivate them well and frequently, not earthing-up the bulging root or stem.

Cucumber.—Seed can be sown anywhere during the month. In the low warm districts plants should be advancing rapidly. To prevent the growth of long shoots, pinch the ends occasionally of main runners to induce the growth of laterals, and this will keep the plants compact.

Cress and Mustard.—Sow seed to keep up a supply. These two salads will need a good deal of watering during dry weather, and to induce speedy growth apply liquid manure once, or even twice, a week, but do not make it over-strong.

Capsicum or Chili.—This is sometimes known as "Pepper." Seed may be sown anywhere, but it is in the warmest districts that the plant will thrive the best. There are numerous varieties, and some of them are very ornamental, and worth growing in the flower garden for that purpose alone. For cooking purposes a very few plants should suffice. The smallest variety is the hottest and most pungent in flavour.

Egg Plant.—Sow seeds or plant out from seed-bed. This plant, or rather its fruit, is but seldom used as a vegetable in Australia. In

European countries, it is made use of extensively. It is worth growing for ornamental purposes, for some of the egg-fruits—white, purple, spotted, and bright red—are very handsome when ripe.

Leek.—This useful vegetable requires a deal of manure and moisture during its growth. Seed may be sown, and any young leeks which are ready may be planted out in shallow trenches like celery. When planting, set the leeks rather deep in the soil, and when they are well grown earth up their stems to blanch them.

Lettuce.—This salad plant, the most useful of all, requires good treatment and attention during the summer months. It is very liable to run to seed if checked during its growth in any way. Sow seed for succession, and plant out a few lettuces from the seed-bed, taking great care not to break more roots than can be avoided. Use abundance of manure, and apply liquid manure, and water freely during dry weather.

Melon, Rock and Water.—Sow seeds freely anywhere. Attend to growing plants, pinch the leading runners occasionally, and keep the plants compact.

Okra or Gumbo.—Useful for its seed-pods, which contain a mucilaginous substance valuable for thickening soups, stews, &c. The plant bears a handsome flower and makes a fine ornament in the flower garden, but the flowers have a peculiar sickly perfume, objectionable to some tastes.

Seed may be sown, or seedlings which have been raised can be planted out.

Onion.—Seedlings which are well above ground must be looked after, cultivated, and weeded carefully. A few more seeds may be sown if more onions are required, during the month.

Parsnip.—Sow a little seed from time to time.

Peas.—Plants should be in full bearing all through the State. Seed may be sown to keep up a succession as long as possible.

Potato.—Plant out a row or two and cultivate well all potatoes which are above ground. Allow one shoot only to grow.

Pumpkin.—Sow seeds freely, and keep the vines bushy as they grow. This is one of the most useful of vegetables, and should always be grown. Sow the best seed obtainable. The old ironbark variety is about the very best to sow if seed can be obtained true to name.

Radish.—Sow a little seed occasionally to keep up a supply.

Rosella.—Valuable in the North Coast districts for preserve. The calyx of the flowers are used for this purpose. The plant is a species of Hibiscus, which succeeds only in very warm moist localities. Seeds may be sown now or seedlings planted out.

Rhubarb.—Those gardeners who desire to raise their own plants should sow a little seed during the month.

Sweet Potato.—A useful summer vegetable, which can be grown over a much wider range of country than is generally supposed. Tubers should be grown for the purpose of providing cuttings. These cuttings can easily be rooted in sand or sandy loam, or in almost any kind of soil,

even stiff, if made free and light with well-rotted manure. As soon as these cuttings are well rooted they are ready for planting out in a bed. The best kind of soil for this vegetable is sandy loam, or they can be grown in almost pure sand if well manured with rotted dung.

Tomato.—Sow seed and plant out strong young tomatoes already raised. These will still need protection at night in all cold districts. In warm early localities tomatoes are fruiting, and in some places already ripening their fruit.

Turnip.—Sow a litle seed in order to keep up a supply.

Vegetable Marrow, Squash, Bush Marrow.—Sow seeds anywhere, and attend to as advised for cucumbers, pumpkins, and melons.

Flowers.

October is one of our best months of the year for flowers, and the most popular of all—the rose—should be in its glory, especially if the season should prove rather moist. The hybrid perpetuals come to perfection about this time, and no kinds of roses can approach these for brilliancy of colour, for texture of petal, or for size. The teas, hybrid teas, and many other varieties and species are beautiful and particularly useful, being almost constantly in bloom, having generally delicious fragrance and graceful habit, but for robustness and grandeur the hybrid perpetuals excel. But with some few exceptions, unfortunately, their flowering season soon passes away, and but few blooms are produced until about the time of autumn. The finest white rose ever raised, Frau Karl Druschki, is a hybrid perpetual, and luckily it flowers quite frequently—almost as well as a tea rose. Another excellent free bloomer is Mrs. John Laing, which deserves to be planted in every garden.

Seedlings of tender and half-hardy annuals should be planted out about the garden. The amaranthus, or cockscomb family, has many beautiful members well worth growing, and of these the ornamental-leaved varieties are exceedingly handsome and worth growing. Seeds of petunias should grow well now, and also salpiglossis, balsam, aster, lobelia, godetia, Phlox Drummondii, sunflowers, convolvuluses, nasturtiums, verbenas, and zinnias.

Where the season is good and the soil moist, bouvardias, as well as numerous seedlings which have been raised, may be planted out, but they will need to be looked after, and probably watered and shaded for some time.

Farm Notes.

Hawkesbury District—October.

H. W. POTTS.

The drought has just broken. It was rendered more severe by reason of the prevalence of bleak westerly winds. Frosts have been quite as frequent as last month, and in consequence of these conditions the outlook for the spring and summer is most discouraging.

The hay harvest will be a poor one. In several places the crops, only 10 or 12 inches high, are in flower. This points to the urgent necessity to provide for quickly-growing summer fodder crops.

Maize.—Apart from the main grain crops to put in this month special efforts must be made to such fodder-producing varieties as Improved Early Mastodon, Red Hogan, and Hickory King.

Sorghums.—The main crop of this very useful plant should be got in on well-worked soil. It will be essential to sow in drills 3 feet apart to provide for shallow cultivation later on. We are facing a dry season and it has to be remembered that sorghums will thrive better under such conditions than maize.

Millets.—The growth of millets is now especially indicated to make provision for stock, not only in the summer months, but also to conserve as hay and ensilage for next winter.

The White French variety on a former occasion provided us with a growth of green fodder available sixty-six days after sowing. The millets are hardy, vigorous and quick growers. They will do best on a mellow soil, rich in humus, but respond to good cultivation on a variety of soils. They are best stimulated with farmyard manure. Failing this, a complete artificial manure may be employed. They will give good returns on higher and drier soils than most crops at this juncture. We use 7 lb. of seed to the acre, sown broadcast. Thin seeding possesses one or two objectionable features and ought to be avoided.

The habit of the plant is such as to render it very susceptible to low temperatures and frosts. Where the land is rich and well-tilled considerably less seed will suffice. It will be wise practice to sow every fortnight to provide a continuous supply of green feed through the summer.

Other varieties may be sown with profit, such as Hungarian, Japanese, New Siberian, and Salger's Dakota.

Broom Millet.—The first of three sowings may be made now. Experience has taught us that the early sowings of broom millet turn out the best crops. Continue to sow every two or three weeks.

Sweet Potatoes.—Seize the first opportunity during wet weather to plant out; the young plants will grow better if first soaked in a solution of cow dung.

Cowpeas.—The main object will be to grow cowpeas for fodder. Density and succulence of foliage can be best and most abundantly secured from Warren's New Hybrid, white and clay coloured. This plant is unaffected by heat and flourishes with a minimum of moisture. Should rain fall after

this it will be equally useful in the direction of using for green manure. Last summer during all the trying heat of January and February we grazed sheep on cowpeas with excellent results.

Pumpkins, Marrows, and Squashes.— Every opportunity should be taken to grow these useful plants for fodder. They prove succulent and reliable food for cows, sheep, and pigs during the summer months. Good table pumpkins brought payable returns last season.

Mangolds and Sugar Beet may be sown in the early part of the month.

Field Carrots.—Where a suitable piece of land can be brought into fine tilth a crop of field carrots may be sown to advantage.

Water and Preserving Melons.—In most instances the sale of melons has been met with good returns. They should be sown this month.

Clarence River District—October.

T. WALDEN HANMER.

Farmers on the Clarence River, and in fact, from what we can learn, on all the Northern Rivers, have been suffering from a prolonged spell of dry weather accompanied by strong drying westerly winds and most unusual frosts. During September even, young potatoes have been frost-bitten, and the planting of crops has been very much delayed.

Those farmers who have not already a piece of lucerne land, will be envying their more lucky neighbours who have. The small patches of lucerne are the only green spots to be seen up this way now, and it is really marvellous how even in this dry weather it continues to grow well.

Sugar-cane.—The dry weather of August and September was severe and retarded planting operations very materially, and those who wish to plant afresh will require to make a start as soon as the weather is favourable.

Maize.—In view of the late frosts and dry spell early plantings of maize probably will not be of much account, but October sowings will possibly turn out very well if showery weather prevails.

Sorghum.—October is a very good month to sow either Amber Cane or Planter's Friend.

River or creek frontages will give the best results as the soil is usually deep; the land should be deeply ploughed and thoroughly well pulverised, harrowed and rolled, and lightly harrowed a second time, before the seed is drilled in or sown. If sown in drills, the drills should be 3 feet apart and the seed sown at the rate of about 10 lb. an acre; if broad-cast, sow at the rate of 18 lb. per acre and harrow in. When sown in drills cultivate the land between the drills as long as possible to check the growth of weeds. A very useful and cheap little machine for broadcast seed-sowing may be obtained for about 17s. 6d. This machine enables a man to broadcast easier, quicker, and much more evenly than with his hand.

The various varieties of sorghum are usually considered drought-resisting, and as they make excellent forage and yield well per acre, the dairy-farmer will find them of great value.

Sow also this month broom millet, pumpkins, squashes, melons, grammas, and buckwheat.

A little lucerne may be sown if the weather is moist, although autumn and spring are the best seasons. Bananas and pineapple suckers may be planted this month. Tie up the young shoots of grape-vines to prevent their being broken by the strong winds, and spray with "Bordeaux mixture" occasionally.

Sow French and butter beans, peas, cabbage, lettuce, carrot, parsnips, turnip, and tomatoes.

Those desirous of trying either cotton or tobacco will do well to plant same this month.

Glen Innes District.—October.

R. H. GENNYS.

Potatoes may be sown this month as required; but the main crop is better left till later.

Sorghums, millets, mangolds, beets, cowpeas, lettuce, cabbage, carrots, parsnips, beet, celery, tomatoes, beans, peas, pumpkins, melons, cucumbers, and squashes of all kinds may be planted.

Maize.—This is a good month for planting the main crop here. The danger of late frosts should be past, and no time should be lost on account of the shortness of the season. The early-maturing varieties are likely to do the best in this climate, amongst them being *Iowa Silvermine*, *King Philip* (*Ninety-day*), *Tuscorora*, *Pride of the North*, and *Prairie Queen*. These have all been tried, and have done well in the district.

Select pure seed, if possible, from a suitable variety, and grow only one sort in a paddock, distant not less than half a mile from maize of another description, or seed will probably be much mixed through inoculation. If possible, secure seed from fine well-filled cobs, the grain from the centre of cob being the most even and larger size, and considered the best to plant. A few at the small end in any case better discarded.

Preparing Land for Maize.—The soil should be deeply worked, say to a depth of 6 or 7 inches, and then well worked with the disc or spring-tooth cultivator and harrows.

If *Check-planting*—that is, several grains placed close together and equi-distant both ways—furrows can be made with plough across the paddock, intersecting one another at right angles. Three to four grains close together should be planted at the intersection, 3 to 4 feet apart. If the land is well prepared beforehand, this work can be done with the cultivator by removing some of the teeth and putting on attachments for making a small furrow; 2 to 3 inches deep is plenty of cover for grain, especially in a moist climate; it is less likely to rot, and if ground is moist will come up quickly.

Maize is often ploughed in, the sowers following, placing the grain right on the bottom of furrow or about half-way up. I prefer the latter plan very much for a wet climate like New England, as the grain is less likely to rot should wet weather immediately follow planting. The seed can be sown

after the plough, either in single seeds about 16 inches or less apart, or several together 3 or 4 feet apart. The former way is the best. The sod will then be turned over on the grain in the ordinary way, and ploughing continued till the required distance between the rows is worked up, the sowers then planting in the last furrow turned as before.

Sowing Single Grains at 16 inches apart from 3 ft. 6 in. to 4 feet apart in the rows appears to give the best results on clean land ; but in *check-planting* there is the advantage of being able to cultivate both ways and keeping down rubbish.

The land should be harrowed immediately after planting, and where a single furrow only is opened up the grain may be covered in this way. When the plants are a few inches above ground, harrowing will also be found to be beneficial. During growth of crop cultivate frequently. The cultivation should be shallower as the plants grow older so as not to cut or injure the roots. In dry weather cultivate frequently both to check weeds and conserve moisture.

Of course, there are various *Corn Drills* for opening up furrows, dropping seed, and covering up, also some with fertiliser attachment for sowing fertilisers when required.

Prepare land thoroughly for maize, select good seed and suitable varieties, and plant carefully. Strong soils should be chosen for maize-growing.

Riverina District.—October.

G. M. McKEOWN.

Hay-making.

The chief occupation in this district during this month will be hay-making, which usually commences about the second or third week in the month.

Oats for hay should be allowed to stand till the upper portions of the majority of the heads are showing white, but wheat should be cut at the flowering stage.

The grain of wheat is not readily digested by horses, and it is therefore better to add to wheaten chaff this or such other grain as may be required. It is desirable to boil or scald wheat for horses.

When cut by reaper and binder, the crop should be promptly and carefully stooked. In order to prevent sweating, which often occurs in large stooks, it will be found desirable to limit the number of sheaves in each stook to, at the most, seventeen sheaves, so as to admit of the free passage of air. By thus limiting the number, it is possible to obtain the best colour in the hay, and this property is essential in produce intended for sale in the Sydney market, where it will command the best prices.

Stacking should be carried out as soon as possible after the hay has been properly dried, so that bleaching may be prevented.

The most convenient size for a hay-stack is one having a capacity of about 50 tons. For this the base should be 27 feet x 15 feet, widening gradually until it reaches 18 feet at the eaves.

Crown Lands of New South Wales.

THE following areas will be available for selection on and after the dates mentioned:—

H.S. or S.L. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
			For Homestead Selection.					
			a. r. p.		a. r. p.		£ s. d.	1905.
*983	Narrabri ..	Dobikin ..	....	1	1,280 0 0	Woolabra, 4 ..	24 0 0	26 Oct.
*982	Narrandera	North Gogeldrie.	....	1	1,238 2 0	Whitton, 16 ..	14 8 10	19 „
			For Settlement Lease.					
			a. r. p.		a. r. p.		£ s. d.	1905.
*810	Condobolin	....	3,784 0 0	2	1,280 0 0 and 2,504 0 0	Condobolin, 7 and 8	14 0 0 and 27 7 10	12 Oct.
811	do ..	....	7,629 0 0	2	3,201 0 0 and 4,428 0 0	„ 20 to 28	46 13 8 and 55 7 0	12 „
*809	Glen Innes..	Glen Elgin and Morven	11,150 0 0	3	3,600 0 0 to 3,850 0 0	Glen Innes, 18 to 22	37 10 0 to 40 2 2	2 Nov.
*812	Narrabri ..	Dobikin ..	....	1	2,560 0 0	Woolabra, 6 ..	57 12 0	26 Oct.

* Available for original holdings only.

For Improvement Lease.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
			Eastern Division.					
			a. r. p.		a. r. p.		£ s. d.	1905. Sale.
603	Cooma	....	....	1	1,016 0 0	Jindabyne, 10; Adaminaby, 16; Cooma, 35.	8 9 4	16 Oct.
608	Tamworth..	Tareela and Tareela North.	....	1	750 0 0	Barraba, 15; Manilla, 35.	6 0 0	16 „
			Central Division.					
1360	Dubbo	Wambangalang.	....	1	5,370 0 0	Dubbo, 18; Macquarie River, 14.	39 3 2	16 „
1344	Narrandera	Kerarbury and Tubbo.	....	1	1,280 0 0	Darlington Point, 8	42 13 4	16 „

For Conditional Purchase.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		a. r. p.			£ s. d.	1905.
Armidale ..	....	220 0 0	Everett	Hardinge ..	1 0 0	26 Oct.
„ ..	Terrible Vale ..	150 0 0	Sandon and Corgi..	Sandon and Inglis.	1 0 0	26 „
Bathurst* ..	....	490 0 0	Winburn	Roxburgh ..	0 16 8	9 Nov.
Bega	....	525 0 0	Bermaguee and Murrah.	Dampier ..	1 0 0	23 „
Bellingen ..	....	45 0 0	Buckrabendinni ..	Raleigh ..	1 0 0	26 Oct.
„ * ..	....	1,100 0 0	North Bellingen ..	„ ..	1 0 0	9 Nov.
Bingara* .	Bingara	270 0 0	Hall	Murchison ..	1 0 0	26 Oct.
„	Cobbadah	3,519 0 0	Cabbadah .. .	„ ..	1 5 0	26 „

FOR CONDITIONAL PURCHASE—*continued.*

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		a. r. p.			£ s. d.	1905.
Boorowa†	....	530 0 0	Binalong	Harden	1 15 0	16 Nov.
Braidwood	....	480 0 0	Warri	Murray	1 0 0	23 ,,
,,	....	1,150 0 0	Corang and Wog Wog.	St. Vincent	1 0 0	23 ,,
Casino *	....	271 2 0	Camira	Richmond	1 10 0	26 Oct.
,, *	....	170 0 0	Wyandah	,,	1 5 0	2 Nov.
,, *	....	230 0 0	Warragambil	Rous	1 0 0	2 ,,
,, *	....	730 0 0	Queebun	,,	1 0 0	2 ,,
,, *	....	400 0 0	,,	,,	2 0 0	2 ,,
,, *	....	382 0 0	Langwell	,,	3 10 0	2 ,,
,, *	....	6,000 0 0	Pocupa	Buller	1 0 0	2 ,,
,, *	....	166 0 0	South Casino	Richmond	5 0 0	9 ,,
Eden	....	40 0 0	Cobra	Auckland	1 0 0	16 ,,
Glen Innes	Within Resumed Area 726.	620 0 0	Yarrow	Gough	1 0 0	23 ,,
Gosford	....	227 0 0	Narara	Northumberland.	0 10 0	12 Oct.
,,	....	269 2 0	Gosford	,,	0 13 4	12 ,,
,,	....	113 2 0	Kincumber	,,	1 0 0	12 ,,
,,	....	80 0 0	Popran	,,	1 0 0	12 ,,
Goulburn	....	440 0 0	Billyrambija	Argyle	1 0 0	26 ,,
,,	....	300 0 0	Cookbundoon	,,	1 0 0	16 Nov.
Grafton	....	50 0 0	Konkadowie	Fitzroy	1 0 0	23 ,,
Gundagai	Wantabadgery	240 0 0	Eurongilly	Clarendon	2 0 0	26 Oct.
,,	Adelong	45 0 0	Euadera	Wynyard	0 18 4	5 ,,
,,	....	550 0 0	Mooney Mooney	Harden	1 10 0	2 Nov.
,,	....	350 0 0	Bongongalong	,,	0 15 0	2 ,,
,,	....	320 0 0	,,	,,	1 15 0	2 ,,
,,	....	180 0 0	Mooney Mooney	,,	1 10 0	23 Nov.
,, and Tumut.	Mount Adra and Bangus.	700 0 0	Ellerslie	Wynyard	0 10 0	12 Oct.
Gunning	....	290 0 0	Grabben Gullen	King	1 0 0	9 Nov.
Hay	Gunbar	560 0 0	Beaconsfield	Nicholson	0 11 8	16 ,,
Lithgow	....	94,000 0 0	Thurat, Alfred, Jenolan, &c.	Westmoreland.	0 13 4	12 Oct.
Milton	....	60 0 0	Farnham	St. Vincent	1 0 0	16 Nov.
Moree	....	640 0 0	Biniguy	Courallie	1 13 4	12 Oct.
Mudgee	....	4,350 0 0	Goodiman and Tuggoon.	Bligh	0 15 0	23 Nov.
Narrandera	Warry (partly)	100 0 0	Warri	Bourke	0 16 8	5 Oct.
Parkes*	....	1,015 0 0	Stanley	Kennedy	0 16 8	16 Nov.
Rylstone	....	5,500 0 0	Kerrabee and Mount M'Donald.	Phillip	0 11 8	5 Oct.
,,	....	34,000 0 0	,, ,,	,,	0 15 0	5 ,,
,,	....	830, 2,000, & 50,000.	Coggan, Murrumbo, &c.	,,	0 15 0	5 ,,
Scone*	....	1,400 0 0	Omadale	Durham	1 5 0	16 Nov.
,,	....	2,500 0 0	,,	,,	1 5 0	12 Oct.
,, and Muswellbrook.	....	7,000 0 0	Mackenzie, Werriwa, Wickham, &c	Brisbane	1 0 0	9 Nov.
Stroud	....	800 0 0	Kornga	Gloucester	0 10 0	26 Oct.
,,	....	260 0 0	Bullah Delah	,,	1 0 0	26 ,,
,,	....	690 0 0	Booloombayt	,,	1 0 0	26 ,,
,,	....	400 0 0	Bindera	,,	1 0 0	23 Nov.
Taree	....	400 0 0	Mackay	Macquarie	1 0 0	16 ,,
Tenterfield	....	800 and 250	Timbarra	Clive	1 0 0	23 ,,
Tumbarumba	Copabella	600, 415, and 640.	Yarara	Goulburn	0 8 4	5 Oct.
,,	,,	115 and 280	,,	,,	0 10 0	5 ,,
,,	....	44 3 0	Goldspink	Wynyard	0 6 8	5 ,,
,,	Ourance	2,250 0 0	Ourance & Welaregang.	Selwyn	0 8 4	5 ,,
Wellington	....	530 0 0	Walters	Wellington	1 0 0	23 Nov.
,, *	....	1,280 0 0	Suttor	,,	1 5 0	9 ,,

* Available for original holdings only

† Available for original and additional conditional purchase.

SPECIAL AREA.

Casino Land District, 129 acres, in parish Fairymount, county Rous; maximum area, 129 acres; minimum area, 40 acres; price, £2 10s. per acre. Available, 9th November, 1905.

Cooma Land District, 25 acres 3 roods 24 perches, in parish Seymour, county Wallace; maximum area 9 acres 3 roods 16 perches; minimum, 2 acres; price, £4 to £12 per acre. Available for originals only 5th October, 1905.

Rylstone Land District, 411¼ acres, in parish Rylstone, county Roxburgh; maximum area, 227¾ acres minimum, 47¾ acres; price, £1 10s. per acre. Available for originals only, 5th October, 1905.

ROBERT McDONALD,
Acting Under Secretary.

AGRICULTURAL SOCIETIES' SHOWS.

1906.

Society.	Secretary.	Date.
Albion Park A., H., and I. Society	Henry Tryer ...	Jan. 17, 18
Gosford A. and H. Association	W. E. Kirkness ...	,, 26, 27
Kiama Agricultural Association	Jas. Somerville ...	,, 26, 27
Berry Agricultural Association	A. T. Colley ...	Jan. 31, Feb. 1, 2
Alstonville Agricultural Society	J. C. Foster ...	Feb. 7, 8
Wollongong A., H., and I. Association (Wollongong)	J. A. Beatson ...	,, 8, 9, 10
Moruya A. and P. Society	John Jeffery ...	,, 7, 8
Gunning P., A., and H. Society	Ernest E. Morgan	Mar. 1, 2
Bega A., P., and H. Society	John Underhill ...	,, 7, 8
Walcha P. and A. Association	S. Hargrave ...	,, 7, 8
Tenterfield Intercolonial P., A., and Mining Association	F. W. Hoskin ...	,, 6, 7, 8
Macleay A., H., and I. Association	E. Weeks ...	,, 7, 8, 9
Fair days	....	,, 9, 10
Berrima A., H., and I. Association (Moss Vale) ...	James Yeo ...	,, 8, 9, 10
Bombala Exhibition Society	W. G. Tweedie ...	,, 13, 14
Camden A., H., and I. Association	A. Thompson ...	,, 14, 15, 16
Newcastle and District A., H., and I. Association...	Owen Gilbert ...	,, 15, 16, 17
Blayney A. and P. Association	H. R. Woolley ...	,, 21, 22
Crookwell A., P., and H. Association	C. T. Clifton ...	,, 22, 23
Tamworth Agricultural Association	J. R. Wood ...	,, 27, 28, 29
Mudgee Agricultural Society	J. M. Cox ...	,, 28, 29, 30
Warialda P. and H. Association	W. B. Geddes ...	April 4, 5, 6
Cooma P. and A. Association	C. J. Walmsley...	,, 4, 5
Richmond River A., H., and P. Association (Casino)	E. J. Robinson ...	,, 5, 6
Hunter River A. and H. Association (West Maitland)	C. J. H. King ...	,, 24, 25, 26, 27, 28
Orange A. and P. Association	W. Tanner ...	,, 25, 26, 27

[3 plates.]

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VOL. XVI. PART 11. NOVEMBER 2, 1905.

Agricultural Gazette of New South Wales.

Seeds and Seed Testing.

(FOR FARMERS.)

[Continued from page 995.]

C. T. MUSSON,
Hawkesbury Agricultural College.

PART II.

Plan of operations in determining the actual value of seed.

HOME TESTING.

IN order to find out the actual value of seed, the purchaser can do a good deal for himself if he will give the matter a little time and attention. The points requiring investigation are :—

(*a*) Genuineness.
(*b*) Place of origin.
(*c*) Condition—
  (a) Purity.
  (b) Vitality.

After having looked into the various points, and made tests as to purity and vitality, it is easy to calculate the actual value of the seed under review.

The method of procedure is as follows :—

(*a*) *Genuineness.*

By "genuineness" is meant that the seed is of the stock or pedigree that it purports to come from.

The specific name of any seed may, as a rule, be readily known on examination, but it is not often possible to tell the exact variety.

It is not until the seedlings come up that closely related species, such as swede turnip and charlock, can positively be distinguished, although there are differences in the seed coats which the microscope reveals. For all practical purposes, it must be taken for granted that the seed is as named. Should there be any doubt about it, a sample must be submitted to some competent authority. Only where a reference collection of seeds is kept for the purpose can the true name be positively determined, and then, in many cases, the specific name alone can be given, varietal differences being so slight as to be mostly indistinguishable until at quite a late stage in the plant's life.

It is an important matter that seed should be true to name. All ordinary crop seeds every farmer knows; but in the case of grasses, clovers, and uncommon kinds it is just as well to get expert advice.

In this matter of genuineness it will mostly be found necessary to rely upon the vendor. Where seed is purchased in the ordinary way from seedsmen, and the requirements have been fully stated, the purchaser can commonly rely upon the seed being as stated. There is hardly likely to be any trouble in this matter in relation to ordinary crop seeds if purchases are made to sample, and under ordinary business circumstances.

(b) *Place of Origin.*

A little consideration soon shows us that this matter is one of no little importance.

In the first place, we know that some districts produce better class crops than others—that no two districts, especially where climatic conditions vary, produce the same varieties in cereals, fruit-trees, or other crops; in other words, that certain varieties are most suited for certain districts. Hence we conclude that every grower has to find out the kinds most suited for his own place, taking into consideration trade requirements, and his own local circumstances. Here comes in the selection of suitable seed; and a most important factor, more frequently overlooked than otherwise, is that of place of origin. Seed may have been grown under circumstances rendering it entirely unfitted for the purchaser; and he should certainly know all necessary particulars in this direction. Seedsmen encourage purchasers to state their local conditions in order that requirements may be satisfactorily adjusted; therefore, buyers should carefully attend to this point when purchasing.

In this connection, the first matter requiring attention at the hands of growers is seeing they get *acclimatised seed.* Better results are obtained from seed grown under somewhat similar conditions as to climate, to those holding where it is to be used. More particularly should we expect this to apply where cropping is on a large scale, as under such circumstances the ground and plants cannot receive that attention which can be given, for instance, to the flower garden, where foreign-grown seed is largely used. According to trials here with lucerne and other plants, best results were obtained from seed grown in New South Wales as against seed obtained from Hungary and America.

Seed should come from somewhat similar climate and soil, if we are to take advantage of all circumstances, and if we *can* so obtain it.

Some consideration should therefore be given to the place of origin of any seed, and for another perhaps more important reason than the above. In the matter of resistance to, and keeping out of, disease; if possible we should obtain seed from districts free, or comparatively so, from disease—in cereals, for example, from smut, rust, or other pests, in order to give our own district every chance.

(c) Conditions.

Testing for Purity.

Select a sample from the bulk seed, taking a little from top, middle, and bottom of a single bag (small seed always works to the bottom if mixed with seed larger than itself)—from every other bag in case of there being more than two or three. Mix it well, and of this take a few ounces and spread it out on a sheet of paper or a plate. With a penknife or a spoon separate all impurities and weed seeds. The sample should be of a given weight. The impurities should be separated and weighed; the percentage of the latter can then easily be calculated.

The weed-seeds should be specially attended to, and an effort made to determine their names. It is quite possible to make up a named set of the seeds of our common weeds for reference. They can be kept in small bottles. The smallest size homœopathic phials cost, including corks, about 10s. a gross. Another method is to gum them in shallow box lids, or store them in some other way.

Our own reference collection of weed seeds is kept in the following manner: Twenty-five trays (5 inches x 6¼ inches) fit in a small cardboard box. A square tea or biscuit tin could be used for the purpose. The circles are cut in thick cardboard with a gun-wad punch, and a sheet of white cardboard is pasted beneath. This method enables a large number of seeds to be passed rapidly under review, seeds being arranged according to convenience, a few of the groups being legumes, grasses, black seeds, composites, shrubs. This gives very little trouble, and any farmer could manage something of the sort with the help of his children, who take naturally to this sort of thing. Of course, many men prefer turning this work over to the Agricultural College or some other authority. Some would like to do it for themselves;—for such cases these notes are written.

Impurities.

Impurities in seed will mean sand, dust, weed-seed, chaff, diseased seed, and the like. Weed-seed is the worst impurity to deal with, as the resulting plants take up space and cause a reduction in the crop, whilst there will follow the difficulty and expense of eradicating weeds that establish themselves.

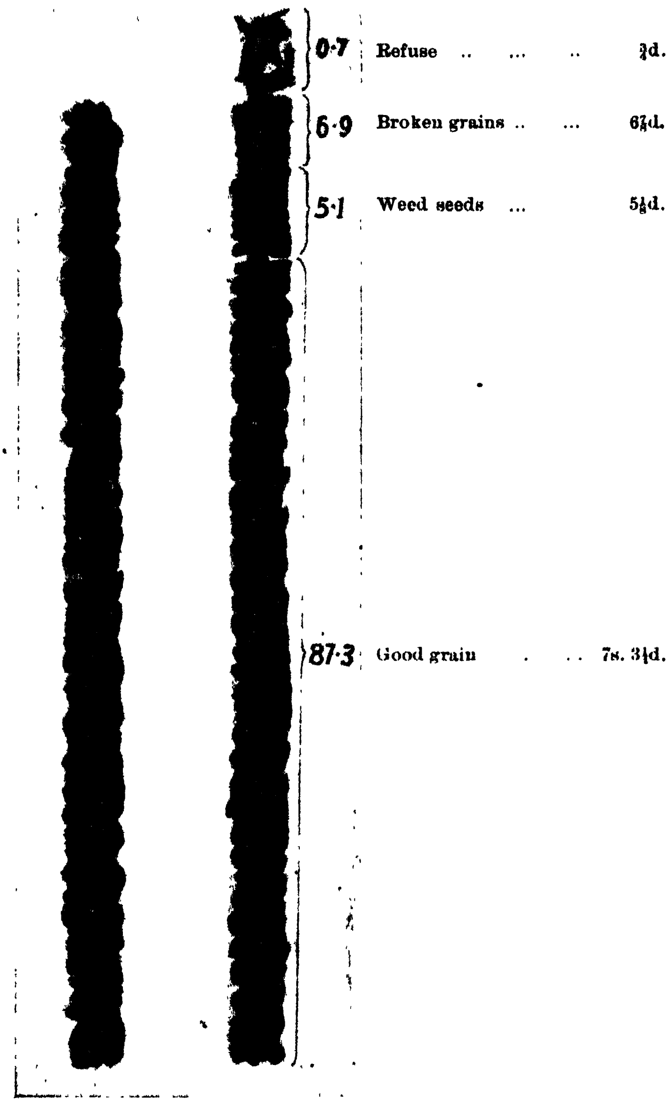
If possible, only real seed should be left in the sample in order to find out the actual purity percentage.

It need hardly be explained that one of the chief causes of weeds spreading is in the sowing of their seed with that of farm crops.

Some weeds are of little account, and are sufficiently kept down in the ordinary course of cultivation; others may become a constant source of trouble, expense, and loss in reduced crops. The loss from weeds being plentifully present has been estimated at from 10 to 35 per cent., varying with different crops. In order to try and prevent this, we should see that our seed is free, or comparatively so, from noxious weed

seeds. Some weeds, when in food crops, result in the flour containing a poisonous substance, as darnel and corn cockle—a most important matter. Other impurities, such as chaff, stalks, dirt, small stones, and the like, are of consequence in that by their presence the weight of

SAMPLE of wheat submitted for report, June, 1903.
(Example 2. as given end of this paper).



What the buyer should receive— 99 % pure. What the buyer received— 100 %. Every 8s. 4d. worth contained as above.

To the miller the broken grain was not loss.

actual seed is reduced. If seed contains more impurities than might reasonably be expected, it should be treated by sifting, or other means, for the purpose of removing the obnoxious matter. If the contained

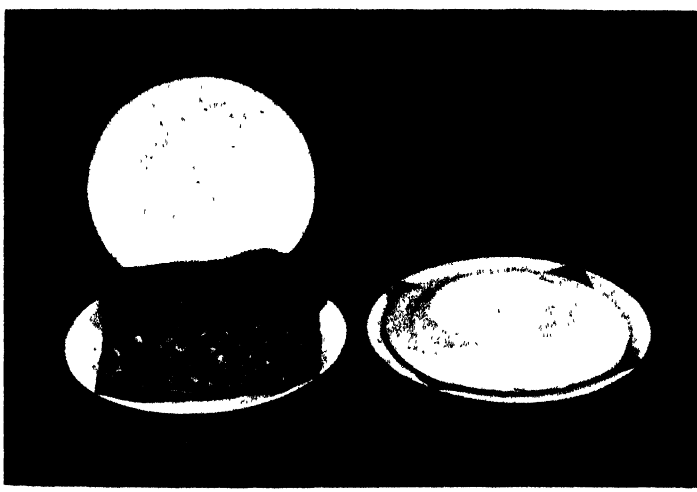
impurities are excessive in amount, the seed should be refused. As to where to draw the line it is not possible to lay down a hard and fast rule. The percentage of weed seeds should certainly not be allowed to increase beyond a reasonable limit.

In the illustration on the previous page an idea is given as to quantity of impurities that may be present—nearly 13 per cent. in this case; far more than there should be; the standard gives only 1 per cent. for cereals.

In dealing with standards later, a table is given showing the margins of deviation as used in the seed-control stations of Europe.

Testing for Vitality.

Take 100 large seeds or 200 small seeds, counting them carefully, from an average sample of the bulk. Do not select only good seeds, but take them as they come—large, small, and broken. It is important that the

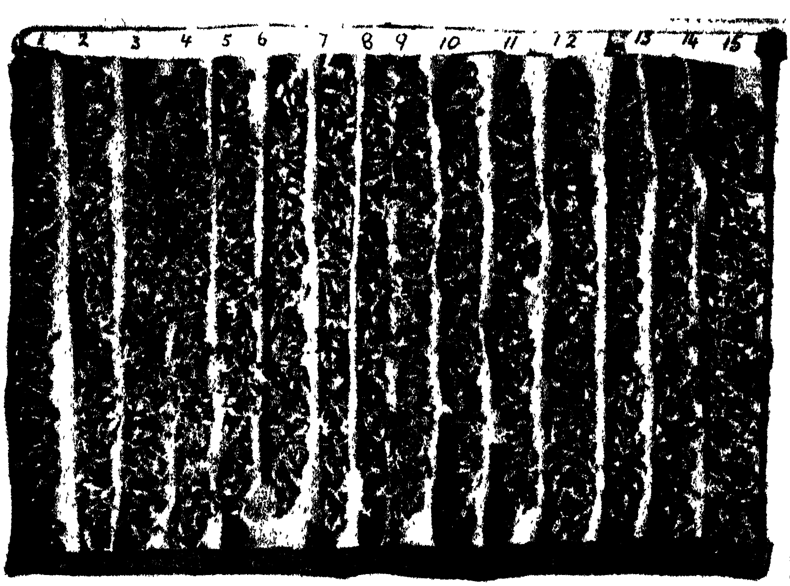


test should be made with a fair average sample of the lot. Then take two plates. In one, as it stands on the table, place a double thickness of blotting paper, folded so that the corners just project beyond the covering plate. Wet this blotting paper thoroughly and drain all superfluous water away. On this place the seed to be tested, with a paper giving name and other details about the seed, written in pencil. Cover the seed with another double sheet of wet blotting paper, from which all water that will run off has been drained away, and cover the whole with another slightly smaller plate, turned upside down. The apparatus should then be placed where it can receive a moderate amount of warmth. From 60 degrees to 80 degrees Fahrenheit will give the best results; the higher the temperature the quicker will the seeds germinate.

In two days examine the seeds, and add water sufficient to keep the absorbent paper moist, but not wet. On the third day, when, in the case

of all ordinary farm seeds, half at least should have germinated, count out all that have germinated and record the result in some suitable way in some book kept for the purpose. Every day thereafter this must be done, up to the time specified in the table given below. A little extra time may be given if thought well, but the test may safely end on the day set out against the particular kind of seed. Below is given a page from a book used here for the purpose. It will give a very good idea as to how the records should be kept. A separate page should be reserved for each kind or variety of seed.

Fresh blotting paper should be provided if that in use becomes badly stained with moulds, as is often the case. White flannel or asbestos sheets may be substituted for the blotting paper, but in such cases the



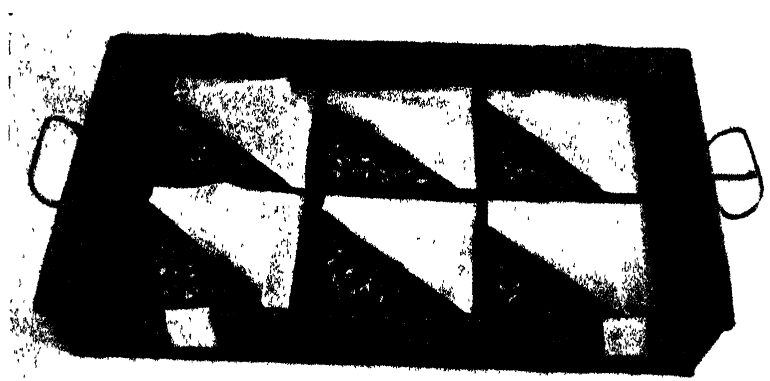
substance must be well boiled before being used again. If this is carried out, the same flannel can be used over and over again. We find here that fresh blotting paper answers the purpose admirably. Some people prefer germinating large seeds, such as bean and pea, in damp sawdust or sand.

In case there should be more than one lot of seed to test, some suitable arrangement can be devised without much trouble. For example, a sheet of zinc or galvanized iron can be bent up at the edges, and used as the common receptacle; on the bottom, strips of thick twine, or straw stems, or thin bits split away from the cane in an old bamboo blind, can be laid across, and wet blotting paper spread over them, commencing at one end, so as to form a series of troughs, half or one inch wide, in

which the seeds are placed. The seeds must in this case also be covered with damp blotting paper or flannel, whichever is being used, the whole being covered by a board or another sheet of zinc.

There are numerous other methods adopted for the purpose, such as the use of a porous saucer or plate similar to those used for flower-pot stands. The seeds are placed therein, and the saucer placed in a shallow tin partly filled with water; the water soaks through the saucer and thus reaches the seeds.

Another plan, suitable where a number of varieties are to be tested, is illustrated here. An ordinary flat tin dish (the one photographed is a common dish used for baking meat), has two narrow strips of iron fitted to carry a sheet of glass about ¾ to 1 inch above the dish bottom. A sheet of blotting paper is spread over it, the ends resting in water with which the dish is filled to a depth of half an inch. It acts as a syphon, and keeps the seeds moist without water having to be supplied, except



to make good any evaporation from the main supply, which it is better to pour away every third or fourth day, to be replaced by fresh water. The seeds to be tested are placed on the blotting paper, each lot covered by its own small piece of blotting paper. In the illustration the six small sheets are of buff paper, the rest red; this to show up the arrangement better. The dish should be covered with a sheet of zinc or a board.

Using any of the methods here described, any careful man can get results sufficiently accurate for all practical purposes. Where an incubator can be used, and the temperature kept at from 75 degrees to 80 degrees Fahrenheit, quicker results can be obtained, though it is not necessary; nor is any artificial heat required beyond that of the ordinary living room or office, except where the climate is cold, or when the test must be made during the winter, and time is of importance.

When opening the apparatus, care must be taken that seeds adhering to the covering material shall not be removed from their proper places.

It should be noted that in order for seeds to germinate well, they must be supplied with moisture, heat, and air. Seeds germinate best in the dark. The apparatus used must, therefore, be such as will allow of these different requirements being supplied as is most suitable for the seeds to be operated on.

Moisture.—There should be enough supplied regularly, but the seeds should not swim in water; superfluous water must be poured off.

Heat.—From 70 to 80 degrees Fahrenheit will give the best results; at lower temperatures germination is slower. Some seed—grass for example—germinates better if the temperature is raised 20 degrees for six hours during the day, then being allowed to resume the normal. For this purpose an incubator is necessary, unless it can be arranged for the apparatus to be placed in such relation to some fire as will bring about the desired result.

Air.—Plenty of air finds its way in between the two plates, which are kept slightly apart by the corners of the blotting paper, whilst the regular openings for examination of any apparatus used will aerate the seeds freely.

Darkness.—This is secured by the covering plate. If, however, any other apparatus is used, this matter must receive attention. All seeds to be tested may, conveniently, be put in a dark place, though the act of covering the plate with another, or a dish with a board, secures sufficient darkness for the purpose.

Time allowed.—Speed of germination is important; most farm seeds should start in from two to seven days.

The time allowed in making any test varies with the kind of seed. Most varieties of ordinary crop seeds germinate freely. The test may be stopped at the end of the periods stated below.

10 days—For most cereals, legumes, vegetables, rape, turnip.
14 days.—Beet, sorghum, rye-grass.
21 days.—Grasses in general.
28 days.—Tree seeds in general.
42 days.—Pine-tree seeds.

Where results are unsatisfactory, a second test should be made before a final decision is arrived at. It is better at all times to make duplicate tests, as a check upon the results; and, naturally, the larger the number of seeds tested the more accurately will the results work out.

All apparatus, dishes, trays, flannel, plyers, and other articles used should be thoroughly cleansed after use in boiling water containing a little washing soda. This will minimise the trouble experienced from common mould. Moreover, tin dishes are liable to rust. It is better, when possible, to use receptacles that will not rust.

Certain seeds require special treatment.

Paspalum.

Ordinary tests are of little use with this grass. The best method to adopt is to spread a little on a board, a sheet of glass, or some other hard surface, and with a knife blade held vertically press on the seed; if it collapses the seed-case is empty, but if the knife meets with some resistance, and eventually cuts through the kernel—a fact easily detected—we have proof positive of a real seed being "formed." The number of formed seeds should be counted per hundred. Three or four counts of a hundred each will give an average for good or "formed" seed in the sample. To germinate these is difficult. Warmth and plentiful moisture will usually bring it on, but the process is a slow one, and so far no satisfactory method of getting at reliable results within a reasonable time has been made out. The proportion of "formed" seed will depend on the method of harvesting. A bushel should weigh at least 28 lb., all under this being poor; the variation being from 17 up to 35 lb.

In the case of tobacco, maize, pumpkin, melon, and similar summer-crop plants, the seeds require more heat to start them than is the case in the common cereals and other farm crops from temperate climates. These seeds should not, therefore, be put in the ground too early; otherwise, the soil being cold, they will not start, and consequently they lie at risk of damage from excessive wet, insects, or other troubles.

Lucerne and Clovers.

In the case of seeds of these fodder plants the utmost care should be taken to see that no seed of "Dodder," "Devil's Twine," or "Ringworm" is present; from lucerne and the larger clover seeds it is easily screened away, but this is not so easy to carry out when it is present in small seed.

Beet and Mangel Seed-balls.

These so-called seeds are really grouped fruits; each "ball" should give more than one young plant, often four, or even five; 100 balls should yield at least 200 young plants. In testing these seed-balls, therefore, the young plants should be allowed to develop well, and should then be carefully pulled out of the containing coverings; no part of the young plant should be left therein. This is best done by means of a pair of fine plyers, the records being entered up at each operation.

Experiments are now in progress in the United States to produce a strain of one-seeded Beet-balls.

Hard Seeds.

In the Clovers especially, after testing, certain "hard" seeds remain, mostly of a pale colour, which for the time being have not absorbed water, and consequently will not germinate. They frequently make up even 10 per cent. of a sample.

In some cases, under treatment with warm water, and given time, these may be made to germinate.

Under natural conditions in the field these remain dormant, but may come on after a time; in such cases they would probably only result in small weak plants, consequent upon the earlier plants having got so much ahead, and keeping the others back by shading and crowding.

In taking tests, where such seeds remain, two courses are open to us—(1) To take no account of the hard seeds, merely noting their presence; or (2) to consider them good, and add some proportion of their number to those germinating within a reasonable time—one-third is the usual thing. Authorities differ as to which is the better plan; perhaps it is safer to leave them out of our calculations altogether.

Hard-shelled Seeds.

All seeds with hard coverings, such as lentils, wattle, and many others, should be put into boiling water and allowed to stand for twelve hours before being planted; they will germinate all the better. Many would require drying before that process could be carried out. Peas, beans, onion, and such like seeds may be steeped in hot water, but it should not be above 140 degrees Fahr., as where the skin is tender the germ is liable to damage if the water used is too hot. Wheat, for instance, will not withstand a water temperature of more than 135 degrees with safety. Dry heat at much more than 140 does not affect the germ.

The difficulty with regard to steeping is that wet seed cannot be used in a seed-drill, consequently the seed must be dried after being steeped or the process must be omitted. Flax is a seed that cannot be steeped, as soaking in water causes the production of a gum all over the seed coats, under which circumstances it could not be handled.

Diseased Seed.

A special look-out should be kept for diseased seed. This trouble usually shows itself in the presence of mould lumps or discoloured spots or wrinkles on the skin.

Lucerne seed was recently submitted to us in which the seed surface was covered with these irregular lumps, two fungus parasites being responsible for the trouble, the sample failing altogether to germinate.

Dead germs.

In cereals the appearance of the germ naturally receives much attention Discolouration and an abnormal shrivelled appearance will be the common indications of trouble. Dead germs may be overlooked, however, as is seen by the fact that we recently had submitted a sample of rye which had failed to germinate—the paddock being actually re-sown with some of the same seed. Examination showed at once that all the germs were dead. Probably the seed had sweated in the stack before being threshed,

but the appearance of the seed under a naked eye examination unmistakably pointed to the germs being dead; it was extraordinary how the fact escaped observation.

Grass Seed.

All grass seed will not germinate readily indoors. Some varieties will do so at ordinary room temperatures, but it is found advisable to raise the temperature for such seed to 85 degrees Fahr., or thereabouts, for about six hours each day by placing it in an incubator, or near a fire. Some grass seed germinates more readily on damp sand than between blotting papers.

Much of the supposed grass seed does not contain a kernel; to test such, spread some thinly on a sheet of glass, and place another sheet over it, hold this up to the light, when such chaff as does not contain seed will be clear; where a seed is present it looks much darker.

The Real Value of Seed as found by Testing.

To determine the real value in use (utility value) in any seed, find the purity and the germination capacity in percentages, multiply these together and divide by 100. For example:—If a given sample contains 95 per cent. true seed which germinates 54 per cent., the actual value for use is $\frac{95 \times 54}{100} = 5130 \div 100 = 51$ and a little over. This will mean that taking the actual cost at, say, 1s. a pound for 100 lb., we pay £5 for what is only worth £2 11s., taking the basis of our calculation as perfection; but if we take the cost of 1s. a pound as representing average expectations it ought to be worth $\frac{97 \times 88}{100} = 8536 \div 100 = 85\frac{1}{3}$ roughly, or in money £4 5s., because it should have a purity per cent. of 97, and a germinating capacity of 88. Necessarily a certain margin of variation below expectations should be allowed.

Germination and Purity Standards.

The following table of standards, based on fresh seed, carefully saved, will give a fair idea what to expect in the directions of *germinating capacity* and *purity*. The table is offered provisionally, and whilst having been largely compiled, has been checked off by personal observations.

Vitality.

Whilst it need not be expected that *all* seed will test up to the standards set for germinating purposes, a test should show results coming somewhere near the figures given. Attached to the standards are tabulated results of the tests carried out here; this will give a very good idea as to what results may be expected when testing. For general use it may be taken that cereals should germinate always above 90 per cent.; if below this, there is something wrong and the matter should be looked into.

Oats, it must be remembered, especially black varieties, are particularly refractory. All other seeds should come within the deviation margin of the standard, which is reasonably liberal. Any seed worse than this should be reported to the dealer, and steps taken to secure better results in the future.

If seed is bought on a guarantee test, which very seldom is the case, purchasers have their remedy, supposing the seed fails to test up to its certificate. In most cases, at the present time, seedsmen supply the best seed that can be obtained, and the purchaser takes it with all risks, unless it be absolutely useless. For in purchasing seed the presumption is that it has a reasonable percentage of good seed in it, changing hands on that understanding. It must not be supposed, however, that because a seed fails to give good results on being tested, that it is bad seed, for many seeds are very refractory; in general, however, the test is ample for its purpose in proving quality. These remarks refer to vitality in seeds.

Purity.

All large seed should be free from weed seed and other impurities. Other seed almost always carries weed seed in some proportion; therefore, it should not be expected that seed can be obtained perfectly free from weeds. Many weed seeds are very difficult to separate; in some cases to do so is impossible. As to the latitude that should be allowed in the matter of purity, it may be said at once that this should not exceed 3 per cent.; it is quity a different matter to that of vitality. The presence of some weed seeds should debar the sale of seed containing them—dodder in clover, for instance—for in this case the smaller dodder seed can be separated. Purchasers should obtain a guarantee that lucerne seed is free from this pest.

Growers can, of course, do something to help themselves in this matter. Cheap seed can hardly be expected to be as good or as clean as a higher priced article; the dearer seed may often prove cheapest in the long run. Therefore, we should not expect the best from cheap seed. Pay a fair price and get a good article. Then, again, a little sifting will often get rid of undesirable seeds; grading will get rid of small-sized seed and tailings. These processes may be necessary, for growers frequently come into possession of seed otherwise than by purchase from seedsmen, by exchange or by growing their own.

If we apply the general rules attaching to the attainment of a good clean sample of seed to our own operations in seed raising, we are "doing as we would be done by." Unfortunately, many growers are not possessed of the elaborate outfit and cleaning machinery necessary to the "up-to-date" seed merchant, consequently we stand the best chance of obtaining the best and cleanest seed from those who have the means for properly treating and cleaning.

Seed Standards.

(With results obtained at Hawkesbury Agricultural College.)

	Germination Standard.	Purity Standard.	Percentage of Germination obtained at Hawkesbury Agricultural College.
Barley	95	99	34–99
Beet	150	98	63–114
Beans	95	100	59–100
Buckwheat	92	99	38–44
Burnet (Sheep's,) ...	90	97	88–92
Cabbage	95	99	54–87
Carrot	85	95	19–72
Cauliflower	85	99	54–87
Celery	65	99	......
Chicory	85	99	21–48
Clover—White ...	85	95	70–81
Red ...	90	98	70–97
Crimson ...	90	95	73–98
Cotton	90	98	......
Cowpea	90	100	67–100
Cucumber	90	100	......
Hemp	80	99	24–65
Kale	90	99	66–96
Kohl Rabi	90	99	70–99
Lentils	98	99	73–
Lettuce	90	99	84–90
Linseed	90	95	89–95
Lotus tetragonobolus	90	99	50–93
Lucerne	85	98	0–75
Lupins	90	99	72–98
Maize	90	100	6–98
Mangel	150	98	34–180
Melon	90	100	16–91
Millet	85	99	81–95

	Germination Standard.	Purity Standard.	Percentage of Germination obtained at Hawkesbury Agricultural College.
Mustard	95	99	93–94
Onion	85	99	9–94
Oats—White ...	95	99	0–100
" Black ...	90	99	10–85
Parsley	75	98	......
Parsnip	75	97	30–37
Peas	98	99	64–100
Pumpkin	90	99	62–67
Radish	95	99	62–90
Rye	95	99	0–96
Rape	95	99	90–99
Sainfoin	85	98	65–87
Sheep's Burnet ...	90	97	88–92
Sorghum	90	98	0–98
Squash	90	100	......
Sunflower	90	100	46–98
Tares	95	99	69–99
Tomato	90	99	......
Tobacco	88	98	77–80
Turnip	95	99	38–97
Vetch	95	99	74–86
Wheat	95	99	38–100

Grasses, very variable, according to species.

Paspalum dilatatum—First-class seed should contain over 70 per cent. formed grain; second-class, between 40–50 per cent. grain formed.

Margins of Deviation.

The following margins of deviation in germination, purity, and real value are employed in the German Seed Control Stations :—

(*a*) Germination—5 per cent. for seeds of which 90 per cent. or more germinate, and 8 per cent. for seeds of which 50 to 90 per cent. germinate.

(*b*) Purity—2 per cent. for seeds with a purity of 90 per cent. or more, and 3 per cent. for seeds with a purity under 90 per cent.

(*c*) Real value—6 per cent. for seeds whose real value equals 90 per cent. and over, and 9 per cent. for real values under 90 per cent.

(*To be continued.*)

Ducks and Duck Farming.

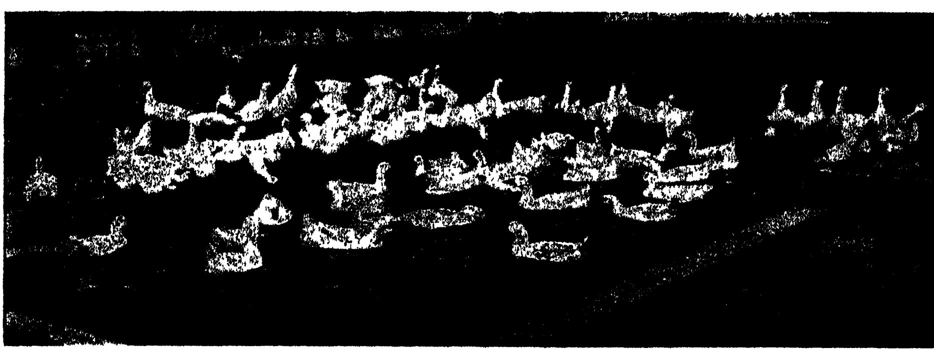
[Continued from page 984.]

D. S. THOMPSON,
Poultry Expert, Hawkesbury Agricultural College.

V.

THE population of Australia has so far been too limited to make duck farming the success it has already attained in England and America. The manless land has been too great in Australia, while the landless man has been left in the densely populated countries of Europe. Our enormous acreage has been devoted to large cattle and sheep stations, and meat has always been a low-priced commodity in Australia, hence the drawback to successful duck farming.

For duck farming to pay well in numerous farms and not in isolated cases, an export trade is absolutely necessary. Duck farming for egg production will pay well, but only up to a limited extent; if there is



Ducks in the Pond at the Hawkesbury Agricultural College.

any undue rush at the game, then many failures will be the result. Duck farming for export will pay very well, but there are two difficulties which must first be surmounted. The first difficulty is of obtaining the right class of duck to breed. Through the tremendous drought which we experienced only a few years ago, the duck stock was sadly depleted, and it has never so far been made good by any large importation of good fresh blood, and it would now be a difficult matter to stock up a few farms with the proper class of duck necessary for breeding for export. The second difficulty is exporting largely, and then keeping up a regular supply once the trade is initiated.

With the right class of duck, easily procurable in the State at reasonable everyday prices, and the initiation of an export trade, by the exportation of uniform quantities, uniform qualities, and regular

shipments, there would no doubt be a payable opening for successful duck farming on a fairly large scale in this State. Duck farming has been successfully carried on in England for many years, but there they have the largest market in the world. London is undoubtedly the largest consuming market in the world for all kinds of produce, consequently the English breeder has always found a ready market and a payable one right at his own doors. We have no such market here, and we are a long way from London. But the English breeder cannot supply his own market, and at times of the year there would be practically a famine in London were it not for the introduction of oversea products. These oversea products come mostly from foreign countries, countries which are mostly unfriendly to England, and no doubt the mother country will always, even if unconsciously, give a preference to the trade of her own people.

A great deal of the wealth of the world is centred in London, and the wealthy can afford to pay for a good article at a convenient time. We must try to supply them with the quality of article required at the convenient time. Therefore it is necessary to catch the top price of the London market by sending only the very best stock.

Duck breeding in England has been largely on the increase, but the consuming ground is increasing faster still. London is now not only the capital of England, or of Great Britain, but is the capital of half the universe, and the rich men of more than half the world centre there. As time goes on the increasing wealth will increase largely the demand for such delicacies as young ducklings for the table of the rich. The market in future years will rapidly increase. The English, the Scotch, and the Irish are all giving great attention to up-to-date agriculture, and great efforts are being made for the rural population to feed the urban population if possible, but spare land in England for duck raising has become less, and this will be greatly to the benefit of the duck farmer of Greater Britain. Our sparsely settled country will afford a good field for duck farmers for some time to come.

In America, which is now largely populated, duck farming is carried on very extensively, many farms turning out some thousands of young ducks every year. Duck farming pays very handsomely in America, because of her immense population. Some of the American cities are very large consuming markets, besides having the London market quite close to their doors to fall back upon, should their supply exceed their demand, or if their prices fall to an unsatisfactory quotation. For us to do well on the London market, it would be necessary, however, not only to send shipments when our local market is glutted, but to send regular supplies, even if the local rates would pay better than exporting. If a good and certain market in London for poultry is found at a satisfactory price, then it will be well to keep up regular supplies, even if it only paid equal to local rates, so long as the trade was retained and much better prices obtained at particular seasons of the year, and in particular years. No good can ever be done by exporting spasmodically.

If we place a good article on the market and it is accepted, it cannot be done without a good deal of speculation and risk, and if, no

sooner than we have been successful in collaring part of the London trade, we cease suddenly, then the whole initiation of speculation and risk has to be gone over again. We must say to the London poulterer of Smithfield: "Here is a sample of what we can do for you in dead poultry, in young ducklings and spring chickens. Will that suit you? If so, what price will you give?" If the price is satisfactory and the article suits them, we must say: "We can supply you henceforth and for ever with dead poultry up to sample. With regularity of shipment, uniformity of quality, and uniformity of quantity, we hope to be able to retain your trade." If exporters undertake to do that, then one of the difficulties mentioned will be surmounted.

Now as to the first difficulty: the procuring of suitable stock for breeding. The Export Branch of the Department of Agriculture requires a minimum weight of 4 lb., dressed, at ten weeks, and the great bulk of the ducks at present in this State cannot be brought up to this weight in the given time, and the question arises—where are the ducks to be found to breed from? Breeders to be able to come up to this standard will have to breed from the best class of duck in the State, which are generally known as Giant Pekin and Giant Aylesbury. With suitable stock of the kind mentioned, and an association to export, there is no doubt that duck-farming would become a lucrative business in the State, and find employment for many hundreds of families in the rearing of young ducks for the English market.

Group of Ducks.

The production of high-class market ducks has grown to be a business of very great proportions in America, and the same can be done here if once we get a proper start.

Mr. James Rankin, of South Easton, Mass., U.S.A., has done a great deal for the profitable breeding of ducks in America, and to him the Americans are indebted for placing a duck on the market which can be rapidly bred up to 6 or 7 lb. live weight at 10 weeks old, and this gave the impetus to duck-farming in America, which is still rapidly extending. Strange to say, but nevertheless true, the supply of good fat young ducklings created the demand in America, and no doubt a demand could be made here if the proper class of duck was placed on our local market, but at present the stock is too select to do this. The importation of ducks into this State has been very limited. For years we have heard of repeated and numerous importations of different breeds of fowls, but ducks very seldom.

We have Rankin's Imperial Pekins in the State at present, but their numbers are very few, and it would not be advisable for any breeder to place these birds on the local market for killers, as under

present arrangements an adequate price would not be received for killers, and it would even pay the breeder worse if they were purchased at killing prices to breed from them. Once there is an association that will pay according to quality and quantity of meat, the number of these ducks in the State would increase rapidly, and the breeder would be willing to place them with this association, where he would have the guarantee that while he would be paid for weight the birds would be killed and would not unfairly compete against him. Another question which an export association will solve will be the question of the size of crates.

The Victorian Government only pack six ducklings in a crate, which makes the grading much easier for the breeder. Mr. P. T. Peppard, the Victorian Inspector of Produce in London, states that the salesmen of the Smithfield Markets advocate grading being done to a difference of a ¼ lb. only. With 20 ducklings in a crate, there are few duck breeders in this State who could put up a number of packages of this size and graded to this fineness. Twenty birds in a crate of uniform color, shape and weight is a big obstacle for the individual poultry-farmer in fowls, but is not nearly so much in ducks, yet it is no easy matter to grade up 20 to a ¼ lb. fineness in weight. An export association would get over this difficulty, as the breeder could be paid for gross weight, and the association could do the grading, from a choice of many deliveries, and then export to Leadenhall or Smithfield.

Just the same in duck-farming as in fowl-farming there are different specialities. If a presuming duck-farmer studies the market, he will be able to decide whether to make a specialty of meat or eggs. At present the profits are in favour of the eggs. To start duck-farming for the meat market you cannot do better than invest in Pekins, and if for eggs you cannot do better than take up Indian Runners. Very little capital is required to start a duck-farm in this State; our climate is so mild throughout the year, that a large duck-farm could be started without buildings of any sort. That is a serious statement to make, and something that will stagger most people, but we speak advisedly and from experience, that so long as the duck-yards are roomy, not overstocked and well clothed with grass, you can run a successful duck-farm without houses of any kind for stock ducks. What a good thing to know—what a great saving in the initial expense, which has in the past helped to kill many a duck-farmer who has started with a good heart. Another great saving we have discovered is that there is no necessity for ponds for the ducks to swim in. This certainly looks very nice and ornamental, but there is no necessity for frill where profit is the object. The extraordinary useless expenditure required to put down ponds is not the only objection. The greatest objection being in the labour involved in periodically cleaning them out, which is labour lost. A duck-farm could be started off with less capital than any other branch of agriculture.

The profit per bird in the last College Hen Test was 8s. 3½d., and the profit per bird in the Duck Egg-laying Competition was 5s. Certainly a very good margin in favour of the hen, so far as profit

from production over cost of keep is concerned, but the interest on capital expended on the duck-farm would be infinitesimal compared with a hen-farm.

In the analysis of the laying of the breeds it was clearly demonstrated that some breeds were useless for profitable egg production, while others were of less protfit than the best. The demonstrating data produced the fact that Indian Runners and Buff Orpingtons would give a larger profit than Rouens, Aylesburys, or Pekins in egg production.

The Buff Orpington ducks went over the hen average at the College, and the fifty-four Indian Runners were very close up to it, with a profit of 7s. 6d. So that this simple data proves that the best laying breeds of ducks and the best laying strains of those breeds will beat the hen every time that interest on capital is calculated. There is a good market for duck eggs, which it is believed will stand considerable expansion. Anyone can start duck-raising who has the necessary land. Suitable land in a suitable locality, and with a few lessons on duck-raising, anyone could start a profitable industry on a very small capital. No houses required to be built, no ponds required to be constructed, and only a 2-inch mesh wire-netting dividing fence in the numerous yards required, and duck-farming carried out on up-to-date methods, in conjunction with market-gardening, would keep a whole family in employment, and it would be found a lucrative undertaking at the same time. Double plots would be the order of the day, and rotation of crops; a crop of ducks taken off the plots followed by a crop of vegetables. No further manuring would be necessary; simply run your ducks on 50 plots of ground for 12 months, and for the next plough up the whole of your 50 plots and grow tomatoes or potatoes, or some other vegetable, which will find a ready market and a profitable price. In this way you would save many pounds in the purchase of manure, while your ducks on new ground would always be fit and well, and you would have no mortality.

Ducks are easily bred, easily reared, and never suffer from disease of any sort, if not neglected. Fowls will fall victims to disease from heredity sometimes, no matter what attention is given them, and although their surroundings are all that could be desired; but ducks, never. If ducks die from any complaint, young or old, there is a screw loose somewhere, which if experience can tighten, the mortality will cease.

For anyone going in for duck-farming, the first question to ask themselves would be, "What shall I make my speciality?"

If eggs, then at present choose the Indian Runner. At present, we say, simply because, although the Buff Orpington has proved itself a formidable rival, the data is not sufficient to demonstrate that they have entirely vanquished the Indian Runner, and, so far for the present, we say, take up Indian Runners, simply because the Buff Orpington has not stood the test of time, and also great difficulty would be found in stocking up with this duck, because of their being at present in the hands of a very few men.

If, on the contrary, you say meat, then a good amalgamation of the Pekin and Aylesbury would be found the most profitable duck, but you must have the proper foundation of size to start from. In our first chapter on Ducks, we speak of breeding Aylesburys for the market, and, in that chapter, we advocate breeding from medium-sized stock for the market. The market referred to there is the local market. Medium-sized stock in these white ducks—Pekin-Aylesbury cross—will be found the most prolific, the easier to hatch, and showing greater fertility, and are just the right class of duck for the present local market, where there is little or no discrimination in size or quality; but for export purposes quite a different class of duck is necessary, and, while the fertility will be less, and the hatching results not quite so good, your profits, if properly placed on the London market, will be far greater. The giant-bred ducks are necessary to produce the necessary weight in the necessary time, and at the same cost, and the ordinary market duck cannot be fed up to the standard weight in the standard time.

The following reports corroborate what experience has taught us. These are recent reports. The first is from the *Australian Hen*, of April, 1905, and is from their Queensland reporter, in regard to a trial shipment of fowls and ducks for the English market:—"The ducks, considered in the aggregate, were extremely disappointing, not a single crate of first-class quality being obtainable from the entire collection submitted for approval." The next is from the *Daily Telegraph*, of February 12th, and is in relation to poultry arriving at the Export Branch, Department of Agriculture in Sydney: "The young poultry offering continues undersized, the fowls weighing 2½ to 3½ lb., and the ducklings 3½ to 4 lb." Again, from the *Daily Telegraph*, of August 27th: "The comparative scarcity of ducks this spring indicates that duck-breeding has to show a great expansion before it regains the position occupied prior to the drought; there is also a natural disinclination to dispose of birds that can be used as breeders. All the same, it is rather surprising to know that an order from South Africa for 1,000 head of English ducks, at a satisfactory price, has had to be passed, owing to the impossibility of securing birds of sufficient size. The stipulated weight was 4 lb. dressed, and after some difficulty less than 100 were secured." Again, the *Daily Telegraph*, of another date, says: "Mr. Bradshaw says fowls are cheaper now in the local market than they have been for some years past; at the same time, he holds that, to attempt an English export trade with the class of goods available would be to court heavy losses."

In England and America, some thousands of ducks are bred and raised annually on very small allotments,—Mr. George Pollard, a breeder of Pekin Ducks in America, having raised 5,000 ducks on two acres of land, but that is rather a risky proceeding. Ducks are almost immune to disease, but raising 5,000 on two acres of land is running a great risk of some epidemic carrying off the whole 5,000 by a fell swoop in a few hours; but here, in Australia, there is no reason to run such an extreme risk.

Tainted ground is the harbinger of enteritis and cholera, and many an epidemic is brought on through it, when a breeder loses all, or nearly all of his stock quite suddenly, and he is quite ignorant of the cause.

Theorists say, give plenty of shade; but we advisedly say there are more poultry lost through shade than through the sun. This remark does not mean we are against necessary shade, but you can have shade of the wrong sort, which will be inimical to successful poultry culture, rather than a help-meet. Wherever the sun cannot penetrate, and fowls frequent, there disease germs abound.

The duck-farmer must be a busy man. We have stated that the industry can be easily floated. We now wish to warn duck-farmers *in embryo* that, while the work will be found congenial to those who take an interest in it, it will be found a great burden, and a huge incubus on those who have no love for the work. The work will be found continuous, and the duck-farmer who is not sufficiently interested in his work will not give it the attention which is necessary to make it pay. All the time he must keep going; very little rest for the poultry-farmer, and no play. His play must be in his work; his interest and sport must be in his work; and seven days a week, and not six, as most people are lucky enough to be able to find lucrative employment at. If you are a sportsman, don't go in for poultry-farming. Unless you are prepared to find all your sport in your poultry-farm, don't invest in one, it will only spell ultimate ruin. Many failures in poultry-farming have been put down to want of experience. Well, that generally has something to do with it, but want of interest is a larger factor in the non-success of poultry-farming. Any man and his family, who have a suitable piece of land, and who are content to get all their pleasure, all their sport, all their pastime, in looking after their ducks and ducklings, and cultivating the soil, cannot possibly fail to make a good living, provided they have suitable land, a suitable quantity of it, and in a suitable locality.

In many parts of England they still use hens for hatching, but in the United States they rely entirely on the machines. In no branch of poultry-farming, however, can machines be more successfully used, as ducklings are more easily raised in brooders than chicks, and, with proper incubators, they are just as easily hatched.

In England, even duck-farming is specialised into different branches. Some only keep stud ducks, and sell the eggs; while others do not keep breeding ducks, but purchase the eggs for setting, hatch them out under hens, and raise them for the market; while others, again, make a speciality of buying the young ducklings already hatched, and finish them off by fattening them for the market. We have seen thousands of them being fattened in Surrey and Sussex, and we have seen them arriving in the Leadenhall Markets in London.

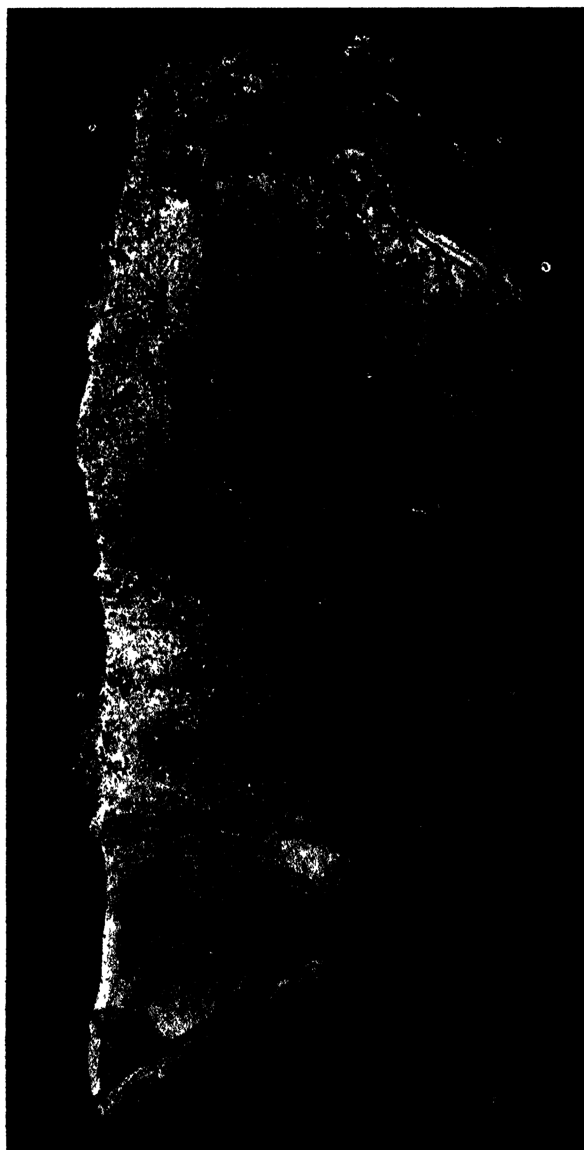
The general average of hatching ducklings in England and America is 50 per cent. of the eggs put down, and we find it about the same percentage here, but this will be treated on fully in our next chapter.

(*To be continued.*)

Actinomycotic Growth on Horse's Leg.

JAS. D. STEWART, M.R.C.V.S.,
Government Veterinary Surgeon.

THE accompanying photograph is that of the lower part of a horse's leg received at the Stock Branch laboratory, for examination, from Mr. C. W. Sabine, Inspector of Stock, who furnishes the following particulars:—"Whilst at ——— station, the manager drew my attention to a cancerous-looking growth on a horse's leg. As it was a hopeless case, the horse was destroyed, and I am forwarding the diseased leg, preserved in formalin solution, as it is a really good specimen. This horse, about two months ago, got a cut on the leg, which was dressed, and the horse turned out. Some time afterwards it was noticed that there was a large growth extending all round the wound, which was treated with powdered bluestone and arsenic, but without any benefit. The manager informs me that it is not unusual for horses to develop these growths after receiving a cut, notwithstanding continued treatment. This horse did not have access to any swamps, but was kept on hilly country near the head station."



Actinomycotic Growth on Horse's Leg.

Microscopic examination of sections subsequently taken from the growth

demonstrated the presence of innumerable colonies of the "ray fungus," a micro-organism which gives rise to the diseased condition called actinomycosis. The original wound had evidently become accidentally inoculated by the ray fungus.

In this country, actinomycosis is most commonly met with affecting the jaw-bones of cattle. The disease is of a contagious nature, and intercommunicable to cattle, horses, sheep, pigs, and man. I have met with several cases of wounds in horses developing appearances characteristic of actinomycosis, but this is the first time I have had an opportunity of demonstrating the actual presence of the causal agent. It is interesting to note that the cases referred to have all been seen on cattle stations, and their occurrence accentuates the advisability of at once shooting and burning all "lumpies" among station cattle. Animals showing actinomycotic or tubercular swellings are collectively termed "lumpies" by stockmen.

The provisions of the Stock Diseases (Tick) Act enforce compulsory notification of the existence of actinomycosis and of "manifest tuberculosis" in stock. With wild cattle, that make treatment for the former disease impracticable, and the application of the tuberculin test impossible, immediate destruction is always the safest and most profitable method of dealing with "lumpies." With stud cattle, that can be handled, and a doubt exists as to which of these two diseases the swelling is due, the tuberculin test is applied to definitely ascertain whether or not tuberculosis is the cause. Should the result of the test be positive, destruction is imperative. If negative, the swelling, or portion of it, is excised, and forwarded for examination, the animal in the meantime being kept isolated. On the nature of the growth being pronounced as actinomycotic, it is the practice of the Department to sanction treatment being carried out under the supervision of a veterinary surgeon or stock inspector. The treatment usually adopted being complete excision of the growth where practicable, local application of iodine ointments, and the administration of fairly large doses of potassium iodide. In advanced cases treatment is often protracted, and occasionally somewhat expensive, but in cases of recent occurrence, where bone is not involved, it produces the desired effect within a reasonable period at moderate cost.

Note on Green Manures.

F. B. GUTHRIE.

AMONGST the most effective methods of increasing the fertility of the soil is the practice of green-manuring—that is, the ploughing under of a green crop. The beneficial action of this operation is a twofold one: it enriches the soil, in the first place, by supplying it with a considerable proportion of readily-available plant-food; and in the second place, by adding humus, and thus improving the soil's texture and its power of absorbing and retaining moisture. When such a crop is buried, the surface soil becomes enriched by the nourishing materials which the crop during the period of its growth has drawn from the air and from the lower portions of the subsoil, and this material is now placed within the reach of the succeeding crop.

During the growth of the plant the soil has, in addition, been stirred up and disintegrated by the development of the roots. When ploughed under, provided that sufficient moisture and warmth are present, the buried mass decomposes with more or less rapidity, and the succeeding crop gets the benefit of the fertilising ingredients contained in the decaying mass of vegetation in a readily-available form. The resulting humus is of the greatest value, not only as a source of plant-food, but in improving the soil's texture, in preventing too rapid evaporation, and in enabling the soil to absorb and retain water, thus rendering it less liable to suffer during dry spells.

A further important result is the formation of carbonic acid by the decomposition of the buried crop. Carbonic acid is given off abundantly in the fermentation of the mass, and assists in the disintegration of the soil and in rendering available the plant-food contained in it.

Green-manuring is effective both in sandy and on heavy clay soils, and, indeed, on all soils deficient in humus. On sandy soils the effect of green-manuring is to consolidate the soil, the humus formed binding the particles together. On clay soils, the effect of the addition of humus and the production of carbonic acid is to loosen and aerate them. When conditions as to warmth and moisture are favourable, and the crop decomposes fairly rapidly, the production of soluble plant-food proceeds with considerable rapidity. This is especially the case in respect to nitrogen, which is the principal manurial ingredient. Nitrification (that is, the conversion of the nitrogenous material of the plant into soluble nitrates) takes place quite rapidly. In sandy soils, green manure nitrifies more rapidly than manures like dried blood, bone-dust, &c., and only less slowly than ammonium sulphate; while in stiff clay soils the green crop nitrifies very much more rapidly than either sulphate of ammonia or animal manures.

With regard to the kind of crop to be used for the purpose of green-manuring, a good deal of latitude is permissible. Any crop that is rapid and

luxuriant in growth, and that can be readily turned under, is suitable for the purpose, and the selection will be guided by considerations such as the time of year at which it is to be grown, its suitability to soil and district, &c. Amongst the most effective class of crops for the purpose are leguminous plants, such as clover, cow-pea, lupines, &c., since these are specially valuable on account of their power of obtaining their nitrogen from the air. They are, therefore, especially suitable for soils poor in nitrogen, and are of high value in enriching the soil with this ingredient. There are, however, many other crops which are suitable for the purpose, and frequently used, such as mustard, buckwheat, vetches or tares, &c. These are all rapid growers, and can be grown as catch-crops—that is to say, after the main crop has been harvested and before the succeeding one is sown. For instance, the practice of growing a crop of tares or vetches after the wheat crop has been harvested is very common in Europe, and can be followed successfully here in districts where the autumn rainfall is sufficient. Such a catch-crop occupies the ground only at a time when it would be otherwise unoccupied, and, during its growth, is collecting plant-food from air and soil, which is utilised for manuring the succeeding crop.

The practice of green-manuring is of special value in orchard work, where the green crop can be grown and ploughed under between the rows.

It must be borne in mind, in all cases, that green-manuring depends for its success upon conditions favourable to the decomposition of the buried green crop, namely, sufficient warmth and moisture. A crop ploughed under in the late autumn or winter will nitrify only slightly, and the same thing applies to ploughing under a crop in a dry season. If the land is quite dry the crop will remain buried without decomposition for a considerable period, and its benefit is lost.

With regard to the actual amount of material supplied to the land by ploughing under a green crop, some experiments were carried out at the suggestion of Mr. Allen, the Fruit Expert of the Department.

The produce of one square yard of crops of vetches, at Wagga, Bathurst, and Hawkesbury College, was harvested carefully, tops and roots, and forwarded for analysis. In the case of the Wagga sample, the roots were obtained by washing away the soil, and Mr. McKeown calculates that he succeeded in obtaining 95 per cent. of the total weight of roots in the soil. The produce of tops from one square yard was 4 lb. 14½ oz., or 10 tons 12 cwt. per acre; and of roots, 1 lb. 9 oz. per square yard, or 3 tons 7 cwt. per acre. Analysis showed that the tops contained 87 per cent. water (13 per cent. dry matter), and ·506 per cent. nitrogen; the roots contained 83 per cent. water (17 per cent. dry matter), and ·213 per cent. nitrogen.

When, therefore, this crop is ploughed under, it will add to each acre of the soil, in the shape of dry matter, 1 ton 7 cwt. tops, and 11½ cwt. roots, including 120 lb. nitrogen from the tops and 16 lb. nitrogen from the roots; a total of 136 lb. nitrogen per acre. Assuming that conditions are favourable for nitrification, this will be equivalent to a dressing of nearly 7 cwt. sulphate of ammonia per acre, or over 11 cwt. dried blood, an enormous dressing.

The soil in which this crop was grown was a light loam with about 25 per cent. clay. The clay is of a tenacious character, and has a tendency to cake hard on drying. The soil is low in humus, containing only about 4 per cent. of this ingredient. It is fairly rich in potash and satisfactorily supplied with lime, but rather low in nitrogen and phosphates. It is, consequently, just the type of soil in which green-manuring should be effective, as the effect of ploughing under the crop will be to break it up and render it more friable, and to supply the deficiencies in humus and nitrogen. Its efficacy is, of course, dependent upon conditions as to rainfall being favourable to its decomposition in the soil. The climate of Wagga is not very favourable to the growth of these crops.

At Bathurst, and at the Hawkesbury College, where conditions are more favourable, the benefits of green manuring are even more striking. Mr. Allen obtained similar samples of tops and roots, representing the produce of one square yard from crops grown at these places, and they gave the following figures:—

At Bathurst, the tops weighed 17 lb. and the roots 2 lb. 5 oz. per square yard, or 36 tons 14 cwt. tops and 5 tons of roots per acre, giving a total of dry matter to be ploughed under of 4 tons 15 cwt. from the tops and 16 cwt. from the roots. Assuming the same nitrogen content in tops and roots as was found in the Wagga plants, this will give when ploughed under 411 lb. nitrogen per acre from the tops and 22 lb. nitrogen from the roots.

At Hawkesbury, the produce was 21 tons 12 cwt. tops and 4 tons 14 cwt. roots per acre. When ploughed under, this would yield 2 tons 16 cwt. dry matter from the tops and 16 cwt. dry matter from the roots. With ·5 per cent. nitrogen in the tops and ·2 per cent. in the roots, the soil will be enriched in nitrogen by 242 lb. per acre from the tops and 22 lb. from the roots.

Lucerne in South Africa.

Mr. Valder, the Commercial Agent for New South Wales at Cape Town, reports, under date 5th September, 1905, that the present price of Argentine lucerne is 5s. per 100 lb., c.i.f. South African ports, or 6s. duty paid. Argentine lucerne measures 100 cubic feet to ton of 2,000 lb. Freight from Sydney to South Africa costs, say, at least 20s. for 40 cubic feet, *i.e.*, 50s. per ton of lucerne of 2,000 lb. for freight alone, and, allowing for other expenses, this would leave a price of about 50s. per ton, f.o.b. Sydney. When lucerne of really good quality is sufficiently cheap, there is a possibility of a good trade being worked up.

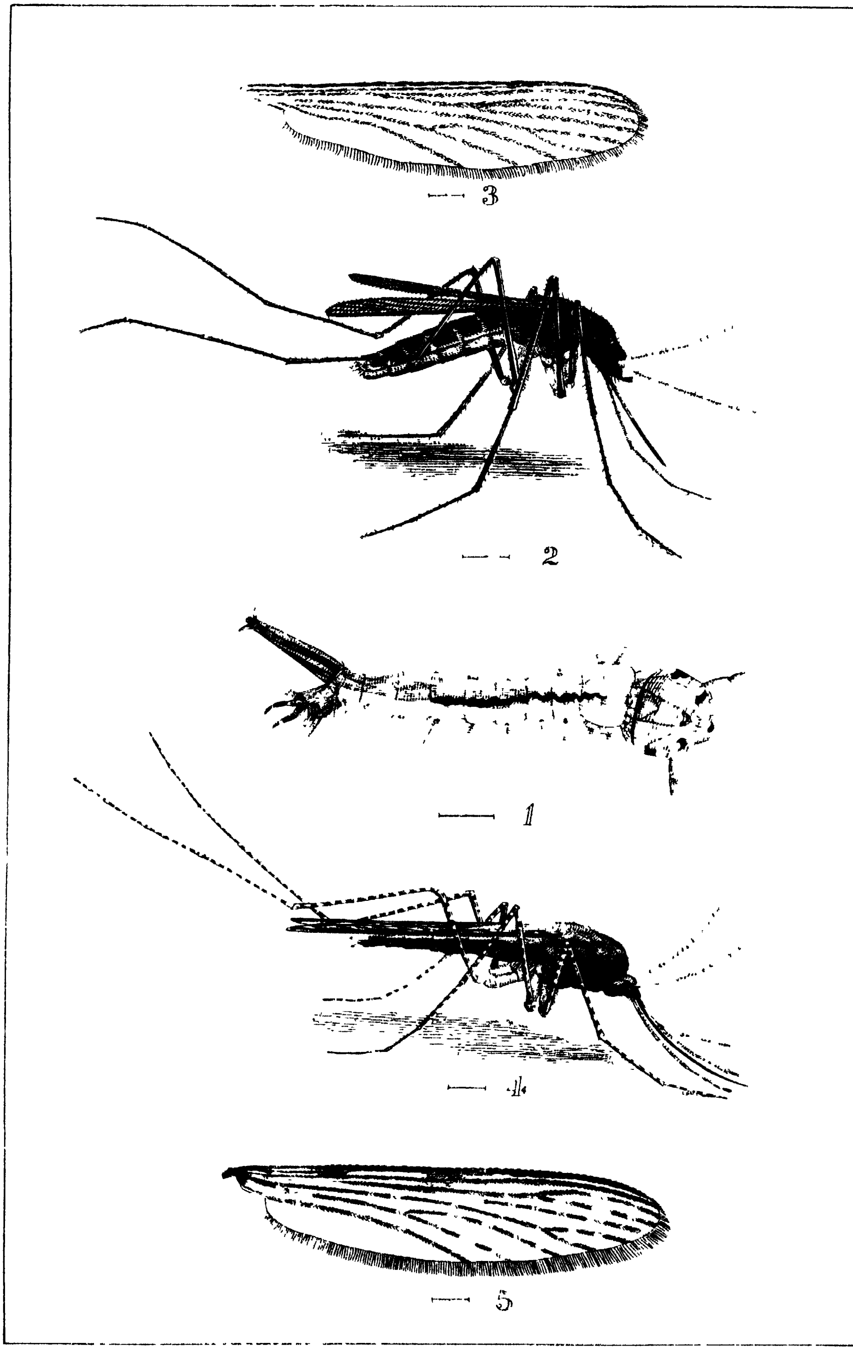
Domestic Insects: Mosquitoes.

WALTER W. FROGGATT, F.L.S.
Government Entomologist.

THE two-winged flies, commonly called mosquitoes, have a wide range over the face of the world, and though there are many parts of Australia where they can be hardly called a pest, yet even in those favoured places they at sometime or other make themselves known to us. In an ordinary season about Sydney they are often a source of worry, discomfort, and bad language for four or five months in the summer time; in the suburban gardens, as soon as the evenings set in, they come hovering round, with their sharp humming ping, that is nearly as aggravating as the actual bite. They later on make their way into the house, and disturb one's rest whenever they can find an unprotected spot to feast upon. This is when the careful housewife takes the mosquito nets out of the press, overhauls them to mend all holes, and hangs them for the summer.

After a wet winter, they are often very troublesome in the back country, swarming over any travellers passing through or camping in the low-lying swamps and lagoons; but in the greater portion of central Australia they are almost unknown, though abundant along the coast and mangrove creeks in Queensland, still, even here, one can camp or work in most of the tropical scrubs without any serious annoyance. They are, probably, worst on the north-west coast of Australia, in the Kimberley district, where, even at midday, they will drive one out of the shelter of the pindam scrub, and one of the first things I noticed in the scrub near King's Sound were large circular shallow pits dug out in the sand, which I afterwards found out were "mosquito camps," constructed by the natives to protect themselves from their bites. When hollowed out, these pits were roofed over with ti-tree bark, leaves, and sand, leaving an opening on the side through which they could crawl, and the last man to enter closed it up with a bunch of grass. Here they lay all night like a family of wombats, in an atmosphere one could almost cut with a knife before morning. In the same district, not only were the mosquitoes swarming all night, but we had to do all our bird-skinning, writing, and packing specimens inside a close cheese-cloth net in the day-time. At night, every camp and tent had a supply of cow-dung burning, which sent up its odorous, pungent smoke, almost as bad as the presence of the mosquitoes, until one became used to it.

Though one would expect to find tropical explorers complaining about mosquitoes, and speaking about the Malay Archipelago, Wallace says, "he considers the mosquito worse than all the other pests, such as scorpions, spiders, centipedes, &c., put together, to be found in the



AUSTRALIAN MOSQUITOES.

1. *A Culex larva*
2. *Culex fatigans*
3. *Wing of Culex fatigans*
4. *Anopheles annulipes*
5. *Wing of Anopheles annulipes*

tropics," still one would hardly expect to find them in northern latitudes; but whole districts in some parts of Lapland, in the brief summer days, are enveloped in clouds of these pests, and Markham states that his men, when trying to take an observation on an iceberg in his Arctic expedition, were driven off by the millions of mosquitoes that assailed them. We do not hear much about mosquitoes in England now, but in the fen lands of Norfolk the inhabitants used gauze coverings for their beds, according to an old writer, if they do not do so at the present time.

The mosquito is a native of districts, generally speaking, of a warm climate, where there is plenty of stagnant water; it does not exist in waterless country, nor flourish in rapid streams. It must have water on which to develop; but, at the same time, a little is quite sufficient for its purpose, and a neglectful horse-trough, bucket, tank, or small waterhole will supply sufficient to breed enough mosquitoes to disturb the peace of a whole district. A few years ago a plague of mosquitoes appeared in the Royal Botanic Gardens at Peradeniya, in the highlands of Ceylon, where these pests were previously unknown, and when the matter was investigated by Green, he found that the gardeners, in thinning out the clumps of giant bamboos, had cut them off often well above the joints, and the water had accumulated in these natural cups in sufficient quantities to allow mosquito larvæ to develop. As soon as the cause was removed, by trimming down the bamboos, the mosquitoes ceased to be a pest.

As a general rule, mosquitoes are not migratory; those bred in a district remain within a short distance of their breeding grounds, and of the millions that come forth a very small percentage ever taste human blood, or that of warm-blooded animals; they are, under natural surroundings, vegetable feeders, living on the juices of plants. This can be easily demonstrated by placing a few slices of freshly-cut cucumber on a plate in a mosquito-infested room; they will soon find and settle upon it, pressing in their proboscis and sucking up the moisture with evident relish. The habit of blood-sucking is simply acquired, and it is a case of "how oft the means to do ill deeds, make ill deeds done."

In the old books on popular natural history, when the writer wished to find a use for every creature in the universe, he sometimes got over the difficulty as regards gnats and mosquitoes, by suggesting that mosquitoes by biting man in tropical countries rendered him immune from malarial fevers; but, with our latter-day investigations, it is conclusively proved that it is by the action of the mosquitoes biting man that many of the most deadly maladies of the tropics are contracted.

King was one of the first men who suggested this connection, in a paper entitled, "Insects and Disease—Mosquitoes and Malaria," printed in the Popular Science Monthly, 1883, New York; he did not go any further, but in the following year Manson published his "Metamorphosis of *Filaria sanguinis-hominis*" in the Transactions of the Linnean Society, and the same writer again contributed an article, "Malaria and the Malarial Parasite," to the Popular Science Monthly, in 1900. Dr. Bancroft, of

Brisbane, has studied the subject in Australia, and made many important observations on the life histories of our species, while Major Ross has, during his connection with the Liverpool School of Tropical Medicine, made investigations, which have been followed by many others of world-wide importance.

At the present time the members of two genera are known to be able, by their bites, to cause malarial and yellow fever, and we are only at the beginning of our discoveries. In the cases of malarial fever, the members of the genus *Anopheles*, of which we have several species described in Australia, are the culprits; but the Cuban yellow-fever mosquito of South America belongs to the allied genus *Stegomyia* (*S. fasciata*).

Thus the mosquito, within the last few years, has been one of the best written-up and most sought-after creatures in the insect world.

The practical value of these investigations can hardly be estimated. Sierra Leone, on the east coast of Africa, on account of its deadly fever, was long known under the name of the White Man's Grave. It was here that many of the mosquito experiments were carried out by the members of the Tropical Malaria Fevers Commission, and the precautions that have since been taken in closing or filling up their breeding pools, and destroying all mosquitoes that come into the houses, have produced a marvellous reduction in the numbers of deaths from fever in that country. In Italy, through the precautions taken at the suggestions of Professor Grassi, fever has greatly decreased in the malaria-haunted districts of the south.

In many of the fashionable watering-places in the United States, large sums of money have been spent by committees of the residents in exterminating the mosquitoes that kept their summer boarders away from their town.

In Hawaii, where mosquitoes are a serious pest, though Van Dine says that they were unknown in the islands until 1826, when they were brought over from Mexico in a ship named the "Wellington," since which two other species have been introduced. A good deal of work has been done in these islands to clear out the mosquitoes. The entomologist, after a thorough investigation, came to the conclusion that the bulk of the house-mosquitoes were bred in the tubs, buckets, and disused receptacles about the native huts, so he had a card of directions (which was printed in five different languages so that the polygot inhabitants could all read the instructions) printed and distributed all over the islands, in which the natives were advised how to treat all mosquito-infested water, and not to allow it to accumulate in buckets and such-like utensils.

The life history of all mosquitoes, as far as it has been studied, is much the same in all the species of the typical genus *Culex*, but the members of other groups differ both in structure and the localities they frequent, so much that a broad classification might be made in calling them house-mosquitoes and forest or swamp mosquitoes.

Very little has been done in describing Australian mosquitoes, until, under the direction of Macleay, Skuse took up the work of describing

the Diptera of the Macleay Museum, which afterwards broadened out into a Monograph of the first sections of the Diptera, in which he described and listed all our known species and added a great number of new ones. (Proceedings of the Linnean Society, N.S.W., 1889.) Since then, Theobald in his Monograph of the Culicidæ of the World, 1900-1903, with a great deal more material to study, has struck out several of the old species, but added a few more, so that our list is still about thirty-four described species, included in a number of different genera, of which twenty-one belong to the genus *Culex*, and four to the genus *Anopheles;* several of these are to be found between Sydney and Newcastle, and from one, *Anopheles musivus*, (*Anopheles annulipes*), Dr. Dick, of Newcastle, located a fever-producing species. The members of genus, according to Theobald's map of their distribution, range from Tasmania to Cape York, but have not been recorded from the western or central portions of Australia.

The life history and development of the mosquito is a very interesting study that can be very easily undertaken by any one with a covered fish-globe half full of water. First, take a bucket of water and place it over night in a shady mosquito-infested corner of the garden; when you examine it next morning you will find several little boat-shaped objects floating about on the surface of the water, which, on examination, you will find are composed of a mass of elongated eggs, loosely stuck together. Place them carefully in your covered water, and next morning you will find that they have hatched out, and the water is full of tiny thread-like creatures with a knob for a head at one end, and slight tubular expansions on the other extremity. If you watch them carefully you will see that they always come racing about in a series of jerks, with tip of the body upwards, regularly coming to the surface to breathe, which they accomplish with the apparatus at the tail end. These little creatures grow rapidly, and in seven or eight days are full grown, when they change into the pupal state, and have quite a different appearance; the upper portion (head and thorax) is drawn up into a rounded mass, with two trumpet or funnel-shaped horns rising up on the sides, which are its new pair of breathing tubes; it may be remarked that it is not a common thing for a larval insect, with its breathing apparatus in the tail, to produce them on the sides of the head when it changes into a pupa. The abdominal segments are short and turned down, so that the pupa, though it does wriggle about a little, generally rests in an upright position floating close to the surface unless disturbed; for two or three days the insect remains in this semi-quiescent state, when, all being well, the skin on the top of the head splits, and the perfect mosquito emerges, and, resting close by, drys its wings and flies away. If it is a male it has delicate plumed antennæ forming a feather-like process on the sides of the head; the proboscis is not so prominent, and it is much smaller than the female; it is not aggressive in its disposition, but flies away into a dark sheltered corner, seldom ever taking any food during its short span of life of four or five days. They have a very low droning hum when numerous

and disturbed in their hiding-place. The more robust females, which usually emerge after the males, though hiding at first, soon come out to hunt for blood, and live a good many days longer than the males under ordinary conditions.

We have several species that may be classed as common house mosquitoes, among which are the following:—The large banded mosquito, *Culex alboannulatus*, which appears in the houses in October about Sydney, and has a wide range up the eastern coast as far back as the Blue Mountains; this species seems to die out about New Year, when the smaller dark species is our common pest, and bites much more viciously than the earlier large one; this is *Culex marinus*, which I have bred in numbers from larvæ taken out of an exposed bucket of water at Croydon, and captured round the lamp on the Hawkesbury River. It is one of our most annoying night mosquitoes, and sometimes comes out very early in the evening, and from its dark colours and smaller size is not so easily noticed as the earlier large species. Bancroft has bred this species from larvæ from salt water, from which Theobald gave it the name of *marinus*. It might be remarked that one of the American methods of destroying the mosquito larvæ in swamps or lagoons which are too big to fill up is to cut openings into them, so that the sea will flow in and render the swamps brackish, but it is evident that such methods would not have much effect on larvæ breeding in salt water. *Culex fatigans* (Fig. 2) is one of the species with a world-wide range, and is found in Australia. *C. macleayi* and *C. skusii* are said to be only varieties or subspecies of this mosquito. It is said that one of our mosquitoes was introduced in the water-tanks of the old sailing vessels in the early days of the settlement of Australia, so that it is probable that it was introduced into Sydney at a very early date.

The famous large mottled mosquito popularly known in the Newcastle district as the "Hexham Grey," a very large and savage mosquito, was described by Skuse under the name of *Culex hispidosus*, but has since been found to be identified with a species described by Westwood, and is now known as *Mucidus alternans*. The best known of our species of the notorious genus *Anopheles* is the one named by Skuse, *Anopheles musivus*, but it is now said to be identical with Walker's *Anopheles annulipes* (Fig. 4).

Remedies and Methods for keeping Mosquitoes in check.

The very fact that a greater part of Sydney has now come under the underground sewerage system has had a great deal to do with closing up a great many places where, in former times, mosquitoes were able to lay their eggs and develop. The reticulation of the city and suburbs with water-pipes did a great deal in closing up thousands of tanks, open and underground wells, and other primitive receptacles for household water, and was another nail in the mosquito's coffin.

There are still, however, in nearly every suburb, plenty of unprotected pools, underground tanks, and swampy patches in which mosquitoes can find breeding-grounds, while the thoughtless or careless householder

can, by leaving half a bucket of water in the backyard for a period of, say, ten days in the summer time, breed out enough mosquitoes to stock his own house, and the neighbours on both sides, for the rest of the season.

Now, with a little care and forethought, and a knowledge of the mosquito's habits and life history, it is quite evident that if all the householders of an ordinary dry, well-drained district are unanimous in their arrangements, they should be able to stop every mosquito from laying its eggs in their district. First of all, water tanks, or receptacles on which water remains for over a week, should be so covered that a mosquito could not reach it, and if by chance they did infest the water, the adult mosquitoes could not get out.

Any open troughs, buckets, and tubs in which rain-water accumulates, should be regularly emptied very week. Where there is a well which cannot be closed up, and the water, if used, is drawn from below by tap or pump, a dose of kerosene oil should be poured into it; 1 oz. of oil will cover 15 square feet of the surface; it will not injure the water, but form a fine film of oil over the surface and kill all the larvæ and pupæ in the water, for if they cannot come to the surface to get air they die, and the thinnest skin of oil effectually precludes them from obtaining a supply of air. This method can easily be applied to all sheets of open stagnant water, which is not used for anything from the surface.

If ornamental garden ponds and creeks are stocked with small fish, and the common gold-fish is one of the best, they will soon devour all the mosquito larvæ and pupæ as it comes along, and keep it clear of these pests before they have time to mature.

Among the natural enemies of the adult mosquitoes are the different species of our large dragon flies, popularly and very improperly called "horse-stingers," for they cannot sting, and only come round the horses to catch gnats and mosquitoes. The dragon flies, with their wonderful powers of flight, might be likened to insect hawks and eagles, and, in the adult state, live almost exclusively upon gnats and mosquitoes. Among the most useful of the birds are the different species of our swallows, martins, and swifts, and if there are any group of birds that should have special protection for their insectivorous habits, it is these birds. You have only to watch them sailing round on a summer evening, always snapping their food as they circle by, rising and falling as the weather changes, and their food-supplies shifts its quarters, to understand what an immense number of insects it must take to keep them going all the year.

The Effects of Fumigation with Hydrocyanic Gas upon Ladybird Beetle Larvæ and other Parasites.

WALTER W. FROGGATT.

In an attack upon the officers of the Department of Agriculture by Mr. George Compere, published in a letter to the *Daily Telegraph*, 6th August, 1904, he wrote: "One of the experts of the Department who was giving a demonstration to some fruit-growers at Pennant Hills as to the methods of fumigating trees, made the statement 'that the fumes would reach any scale and kill them,' and when one of the fruit-growers asked him how about the friendly insects which might be on the tree, the expert replied 'Oh, that is the beauty of fumigation, it will kill scale insects but not parasites.' Mr. Farnell can furnish you with the names of some of the men who heard the remark made."

Now Mr. Allen, the Fruit Expert, who has had a very large experience in fumigation, seeing this newspaper article, wrote a very courteous letter to Mr. Compere, suggesting that he had probably not done much in the way of fumigation, and again stated that he had never found dead ladybird larvæ in the tent after fumigation, and gave his reasons for this assertion. He received the following reply :—

Dear Sir, Marseille, 4th Oct., '04.

Your letter dated 22/8/04, and addressed to me at Perth, was awaiting me upon my arrival here. In reply will state that I was very pleased to have received it, as it bears out just what some of the fruit-growers of your State told me. To make the statement that a charge of hydrocyanic gas will kill protected and armoured scale, and not kill the ladybirds or their larvæ is ridiculous.

Resp.,
GEO. COMPERE.

Now knowing we were right we have waited for confirmation from experiments outside the Department, which now comes in the form of a letter from Mr. Luke Gallard, of Kenthurst, who is well versed in both the methods of fumigation and the habits of parasites. After tabulating the insects he found dead in the tent during a fumigation experiment (*Daily Telegraph*, 19th August, 1905), he says, "Amongst those which were found to revive were about one-and-a-half dozen steel-blue ladybirds, some ladybird larvæ, three syrphid fly larvæ, about 150 'dicky rices,' several apple borers, and a number of green froghoppers."

Again he fumigated "two steel-blue ladybirds, one brown lace-wing fly, several ladybird pupæ, and one green lace-wing larvæ, enclosed in a piece of gauze tied in the centre of the tree," and only the lace-wing died. He has since bred parasites out of *Icerya purchasi* which had been killed by fumigation, the gas not having affected the pupæ in the dead scale.

The contention of the parasite entomologist, that fumigation kills the parasites, thus falls to the ground, and I will here make a few remarks upon the action of hydrocyanic acid gas upon plant and insect life, bearing on this subject: Hydrocyanic acid gas is identical with prussic acid gas. Under the artificial conditions of fumigation, when we fill a tent with prussic acid gas, a certain amount of it is absorbed and retained in the bark and tissue of the plant; if the foliage is wet or damp, an excess of acid is deposited (for prussic acid is very soluble in water) on the foliage, with the result that the leaves are damaged, turn black, and fall off. Now the armoured scale has its beak or sucking mouth buried in the tissue which becomes charged with these poisonous fumes, and is killed by imbibing as well as inhaling. This is the reason that fumigation is so fatal to armoured scale, and only stupifies free insects clinging to or crawling over the bark. Another thing is that the disturbance and jarring of the tree in placing the tent over it causes the bulk of the ladybird and larvæ to fall to the ground, where, half buried in the earth, they save their lives, because the generated gas is very seldom dense for long at the base of the tree, but rushes upward, until it is gradually dissipated through the fibre of the tent. As the gas leaves them, the insects on the ground come to again. The insects such as fruit fly, house flies, and other insects that fly upward in their endeavours to escape are forced into the densest fumes of the imprisoned gas and die at once. Hydrocyanic acid gas has not nearly the same killing power over many weevils. We have hung up a dozen of the large elephant beetle (*Orthorrhinus cylindrirostris*) that lay their eggs in the trunks of the orange trees, right over the basin containing the cyanide and acid before the tent was closed, and they seemed to like it; the "dicky rice" (*Prosayleus phytolymus*), another tiny brown weevil that feeds upon young buds, simply crawls away as soon as the tent is pulled off the tree.

In the case of fumigating houses, if the room is properly closed up, made as air-tight as possible, and the charge of gas sufficient to fill the whole space, the gas seeking the plane of least resistance penetrates into every crack and cranny in the wood, behind the skirting boards, and through the floors, thus killing all such creatures as house bugs and cockroaches.

Luther Burbank.

AN INTERVIEW.

W. O. CAMPBELL.

ON my way through Northern California I stopped over at Santa Rosa to see Luther Burbank about his latest, and what some people consider his greatest wonder, viz., the Spineless Cactus. Before leaving Sydney, the Director of Agriculture had asked me to send any information which might be of interest to the people of New South Wales, hence this interview. Now

Spineless Cactus and one of the parent Cacti with Spines.

Burbank is a man who does things and is always busy, so it is a very difficult matter to interview him. Over 6,000 people from all parts of the world visited his place at Santa Rosa last year—of whom, he sees about one in thirty.

It is impossible in this brief article to describe what Luther Burbank has done for horticulture. For many years he had to struggle along while conducting his experiments and reaping very little financial reward; however, the Carnegie Institute of Pittsburg, Pennsylvania, has endowed him with

£20,000, to be paid at the rate of £2,000 a year for ten years. This enables him to conduct his costly experiments free from any financial worry, and many of his "creations" are now bringing in good financial returns. His great principle in the plant world is in the direction of plant force. If he wishes a plant to have a thicker stem he directs the force in the plant to accomplish that purpose, and so on; if a larger flower is required or an improved fruit, he experiments with thousands and thousands of seedlings, cross-breds, "come-backs," &c., until the variety is fixed.

For instance, the Plumcot, a cross between the plum and the apricot.
The Pomatto, a cross between the potato and the tomato.
The Primus berry, a cross between the raspberry and the blackberry.
The white blackberry, a cross between a wild variety and the hawthorn.
The stoneless plum, the spineless cactus, the crimson poppy, the yellow calla lily, and so on.

Spineless Cactus.

Mr. Burbank is about fifty-six, active, wiry, pleasant-voiced, simple and direct in his talk, but very convincing. He talks as the man who knows.

"Mr. Burbank is out," said the private secretary, "but if you care to wait he will be in soon."

In about ten minutes Mr. Burbank appeared, and gave us a cordial welcome

Burbank: It's a nice day; the weather is very pleasant this time of the year?

Campbell: Yes. California always seems to wear a smiling face.

Burbank: I have a collector in N.W. Australia now, named Vachell. He sends me a large number of seeds, which I experimented with some time ago. I received some flannel-flower seeds from Australia, but I was not successful with them; however your father was kind enough to give me some hints about growing them, and I now anticipate success.

Campbell: Mr. Burbank, I believe, as regards Australia, your spineless cactus will prove one of the greatest benefits you have given the world.

Burbank: Yes. I follow Australian conditions as closely as possible, and it will be especially valuable in the dry spells you have there; but I want you to remember this: I am not the creator of a spineless cactus; there are several small varieties of spineless cacti growing on the shores of the Mediterranean and in Central America. My cactus was produced by crossing the spineless cactus from Central America with the Arizona cactus and other hardy northern varieties of the opuntiæs. It is not only useful as a pasture plant, but the fruit will be valuable as a fruit, and will have a delicious flavour. Even the leaves can be fried and eaten—not boiled, but fried in butter.

Campbell: Has it reached perfection yet in your eyes?

Burbank: No. It will be two or three years yet before I place it on the market.

Campbell: How long does it take to make a new variety?

Burbank: Generally it takes six generations to fix a variety. Sometimes it is accomplished in one, but not often.

Campbell: Is the cactus easy to grow?

Burbank: Well, many people imagine all one has to do is to plant the cactus and, when grown, let the stock eat it down.

Campbell: Yes, that was my idea.

Burbank: My cactus will pay to cultivate, like any other crop. If there is any part of a ranch a little moist, plant it there. Fence it in when grown, break off the leaves and feed it to stock like any other food.

Campbell: What is its value compared to other foods?

Burbank: As valuable as alfalfa (lucerne).

Campbell: Your first great success was the Burbank potato, was it not?

Burbank: Yes. Statisticians have computed that the Burbank potato has added twenty-five million dollars (about £5,000,000) to the general wealth of the United States.

Campbell: There are many things besides the cactus that you are now experimenting on?

Burbank: Yes (smiling). I have over two thousand different experiments on hand now, including a frost-resisting plum, the Australian everlasting flower, the Colarado rubber-plant; while in varieties, I have over 300,000 different varieties of plums.

Campbell: Over three hundred thousand!

Burbank: Yes [repeating the figures], and over 200,000 varieties of apples, 56,000 of cherries, 8,000 of chesnuts. My chestnuts come into bearing in eighteen months, or six months after grafting.

Campbell: It is hard to realise how much work you have done?

Burbank: Well, you see, after one makes a start results move in a geometrical ratio. When a plant comes to maturity in eighteen months, that is, to say, six months after grafting, instead of having to wait years, I can work so much quicker. I graft, and again graft, and so on.

Burbank: Have you the Rhodes' grass in Australia?

Campbell: I saw in a Sydney paper that the Director of Agriculture thought highly of it, and advised the farmers about it.

Burbank: He is quite right. In my opinion, it is a first-class forage grass. I am working on a number of forage grasses now.

Campbell: Did your plants come from South Africa?

Burbank: Yes. Cecil Rhodes sent me the first. I was always in communication with him during his lifetime. I used to send him everything I produced.

Campbell: Were they a success in South Africa?

Burbank: Yes, for a time, they made £2,000 an acre from the Burbank plum; but that, of course, was during the days of the gold-fields. Even the thinnings from the trees were sold, and the Burbank plum wants to be thinned very much.

Campbell: Did you ever meet Rhodes?

Burbank: No; but he sent one of his men to visit me here. The experimental farms in Australia seem to be doing good work.

Campbell: Yes. The farmers realise they are now past the introductory stage; now, Mr. Burbank, I feel I have taken up your time long enough.

Burbank: You must not go yet; come and have a look at my garden. My main place is at Sebastopol, about 11 miles from here. Here is the spineless cactus; it is a pasture plant that can be grown on a moist soil, or where it rains twice a year, or once a year. One leaf planted will have six or seven large leaves in six weeks, and one strong plant will produce a quarter of a ton of forage. My difficulty was not only to get rid of the spines, but also the spicules. Now see how smooth it is—and Burbank rubbed his cheek along the velvet leaf of a "cactus."

Mr. Burbank then showed me other cacti in various periods of transformation, and in the glass-house were hundreds about 2 inches high; some spineless, others full of spines.

I then saw the Shasta daisy evolved from a small insignificant weed, and poppy hybrids, which are perennials. Crimson poppies evolved from yellow ones. How? Why Burbank saw a crimson thread on the petal of a yellow poppy; preserved the seed—saved the resulting seed—getting a wider crimson mark each time until the perfect flower was obtained. The same with a scented verbena. He noticed a beautiful delicate scent in the verbena bed. After considerable trouble he located the plant, and is gradually bringing this to perfection.

While we went through the garden, he would every now and again pick flowers of all kinds for my wife. We certainly had a rare botanical collection.

Burbank: That is an Australian tree on the lawn?

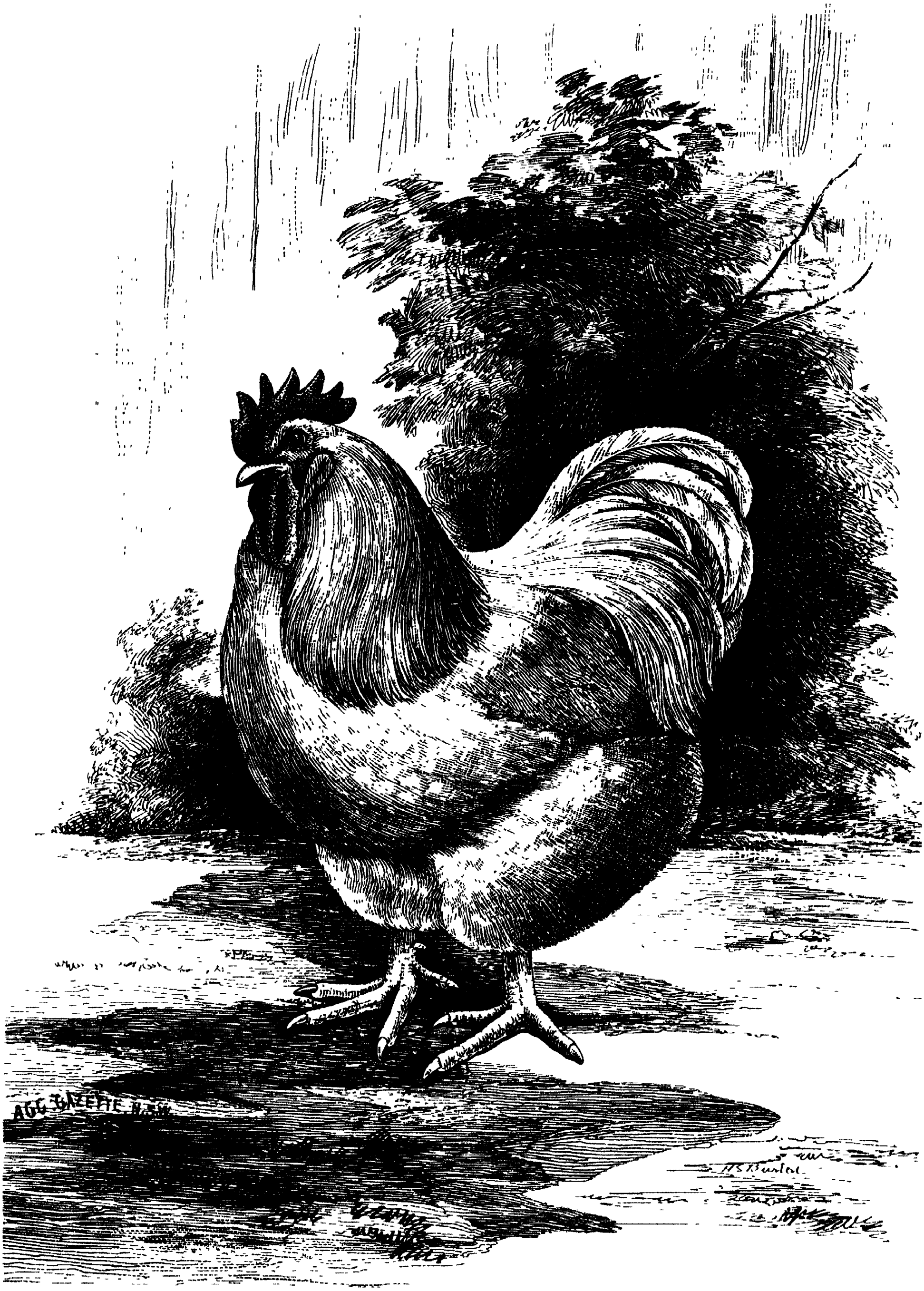
Campbell: Yes, that is a Bunya Bunya.

Burbank: I never heard it called by that name before; we call them the monkey-nut trees here. They are very pretty trees. Here are some pamphlets for your father, with my compliments, and should he ever visit California, tell him he will have a cordial welcome from Luther Burbank.

And so ended my interview; whether or no the spineless cactus will be what we hope it will, remains to be proved; but let us add our thanks to the untiring worker at Santa Rosa, Luther Burbank.

ESTIMATE OF THE WHEAT HARVEST, 1905-6.

READERS who are good enough to act as Crop reporters for the Government Statistician are reminded that it is the intention of Mr. Hall, Acting Statistician, to send out with the next issue of the *Gazette* a limited number of forms in connection with the above. The co-operation of all wheat-growers is invited, so that, if you do not receive a form and are desirous of assisting, a communication addressed to "The Statistician, Sydney," giving particulars regarding area and average yield per acre, will be gladly received. If possible, the form should reach the Statistician's Office not later than 15th December next.



TYPICAL BUFF ORPINGTON.

Farmers' Fowls.

[Continued from page 955.]

G. BRADSHAW.

CHAPTER XVIII.

ORPINGTONS.

Origination.

ALTHOUGH W. Cook had been breeding poultry from 1870, and was in a limited circle fairly well known, it was not until 1882 that poultry breeders generally became aware of such a man. His various contributions to the then weekly poultry journal, *Poultry*, and the publication of a book entitled "Cook's Poultry Breeder and Feeder," brought his name into greater prominence, which, with other causes, may be expected to retain for all time wherever domestic poultry are known. During the years from 1870, Cook was experimenting by breeding, cross-breeding, and inter-breeding several of the then known varieties of poultry with a commercial object, but few were aware of the actual circumstances until 1886, when he sprang on the English poultry world what he called a new breed of fowls. These had black plumage and single combs, and much like the then exhibition Langshan, but with shorter legs and free from feathers. These he called Orpingtons, from the not very prominent Kentish town where he at that time resided. The announcement about them appeared in the two or three journals devoted to the fancy, the reception they received being sufficient to daunt any less determined man, and oblige him to abandon the thought of successfully launching in England a new breed of fowls, Yankeeland being considered to have the monopoly of poultry creation.

The papers and fanciers alike attacked both Cook and his fowls. The birds were alluded to by some as the ordinary black farm-yard fowl, by others as clean-legged Langshans, while those who wished to flavour their remarks with a little sarcasm, denominated the birds as Cook's commoners.

The unmerciful criticisms were all taken in good part by the Kent enthusiast, who believed he had manufactured a good commercial fowl, suitable for the back yard of the city breeder, the road-side rearer, the extensive range of the farmer, and worthy the notice of the fancier, who, like the patrons of the turf, are ever profuse in the justification of their hobby on the grounds of improving the stock. However, I prefer to give Cook's own words relative to his experiments, investigations, and intentions, which culminated in what undoubtedly is one of the most popular and profitable breeds of domestic poultry:

"Many years ago I conceived the idea of adapting poultry keeping to present-day needs, and after revising the methods of feeding and general management, I found that the old breeds were, in many instances, sadly behind these times of scientific investigation and methodical systems of economics. Well do I remember each successive step, and each oft-recurring success, until the sneers of the old breeders, and the opposition of the few, faded into insignificance. A little opposition will be no great hindrance to the furtherance of my great purpose, and I intend always to further it until it be a complete and crowning success. One marked feature of the Orpington has always amazed me as much as it has gratified me, that is, the rapid development and improvement of the breeds. Some may be interested to know to what cause I attribute this rapid development. First, I may mention that in the making of the Orpington, good stock only was used. The birds then came forth excellent, not only in formation, but in material, out of which the breed was formed. The best blood brings vigour and stamina into the birds which nothing else could produce. Then, again, the crossing of the breeds has imparted strength, which the admixture of various breeds has always produced; and the best blood blended upon right principles, of course produces even more excellent results, as each successive cross has left its mark upon the breed. Consequently, we can but foresee not only a great future for Orpingtons, but a greater breed of Orpingtons for the future," adding "the show pen will always possess a strange fascination for many—the fancy will always hold its votaries in obedience; but the great future of the poultry-keeping industry does not lie here, but in the hard-handed, hard-headed toiler on the land—the farmer, the fruit grower, the artisan, and the dwellers in the cottages of the country side—and in these are to be found the material out of which the new order of things is very largely to be evolved."

When the late W. Cook first put Orpingtons on the market, he gave the full history of his experiments, leaving nothing to conjecture relative to the breeds from which he evolved the new fowls. He told the public that he looked for the most suitable material, that is, birds of good breeds and of good laying strains, table qualities, vitality, and constitution. He says:

"I took a good, black Minorca, which variety are extraordinary layers, black plumage, not putting on fat readily, with white flesh and skin of fine texture, but with black legs and tremendous activity. The points I hoped to procure from this breed were black plumage, red face, and large comb and ear-lobes. I procured the finest-bodied cocks of the breed that I could find throughout the country that had red ear-lobes. These had been killed or thought little of before, because they had not white ear-lobes. With these Minorcas I mated some Black Plymouth Rock pullets, which are 'sports' from the American Plymouth Rocks, owing to the Black Java having been used in the making of the Plymouth Rock breed. Plymouth Rocks are hardy birds, winter layers of a brown or tinted egg, and were thought a good deal of when they were introduced, although their yellow skin and legs

have always been against them as table fowls in this country. These varieties when crossed produced black pullets and good shaped birds. The cockerels came of a mixed straw colour, and were of course useless for my purpose. With these beautiful pullets I mated a good Langshan of the old short-legged type, and, as is well known, these birds were extraordinary winter and particularly late autumn layers of deep brown-shelled eggs. They lay when eggs are scarce, more so than at any other time of the year. They are also fine-bodied, black birds, showing an iridescent, metallic-green sheen upon their magnificent plumage. So these birds, with their long, deep breastbone, and white skin and flesh, infused many good qualities into the breed. The feathers down the legs had to be disposed of, and to do this I sought out all the Langshans that were produced without feathers on the legs. These Langshans laid earlier than the feather-legged ones, and, with their breasts curved in that peculiar way which denotes strength of constitution and their fine qualities, they soon set their stamp of real excellence upon the birds. So with the 'wastrels' from good breeds I formed the Black Orpingtons, using birds that represented the poultry of the three continents, viz., Minorcas from Europe, Langshans from Asia, and Plymouth Rocks from America, and three varieties that were looked upon as three of the best for general purposes that England possessed. And the Orpingtons have now been tried and found most valuable birds in the coldest and bleakest parts of America and England, Russia, Holland, and Germany, so that, with Africa, India, Australia, Malta, New Zealand, and Norway, Orpingtons have now spread to nearly every part of the civilised world. In the most trying hot climates, where other birds have died, Orpingtons are thriving and doing well."

This then is how and of what the new ideal fowls were made, and it is but a moiety of the tribute to the originator to acknowledge that of the many breeds and varieties of domestic fowls now extant, there is not one of them that in such a short space of time became so universally plentiful and popular, the breeders generally admitting that the new fowl fills the vacancy which existed in the poultry world—a good table fowl with white skin, a prolific layer of brown eggs, of a good appearance, easy to breed and rear, and fast growers. Cook's own description of them, written eighteen years ago, is as follows :—

"The hens are good sitters and mothers, but not so troublesome as some of the other varieties when not required for that purpose. They are free from feathers on the legs, and have a beautiful black, glossy plumage. They stand confinement, and lay through the severest of wintry weather, producing a beautiful brown egg of a fair size. If required for table they are very satisfactory, being an excellent flavour, and the breast meat remarkably white. The birds fatten up quickly for table when young. They breed true to type, though occasionally some of the cockerels may come with a little red in their hackles or feathers on their legs. The plumage is very glossy on both sexes, but more particularly on the cock. The sheen should be much the same as that of a good Langshan, single comb, evenly serrated in both sexes, standing erect in the cock, not large but very neat, very deep and long

in the breast, red face, black legs, white toe-nails, four toes on each foot well spread out. The male birds should always be fully developed in the points where the hens are deficient. It is always best to mate up unrelated strains. There is nothing like fresh blood, if healthy, vigorous, and good laying birds are required. The Orpingtons have been known to lay from thirty to sixty eggs without missing a single day. The pullets are in full lay at six months old, many of them at five months. They are splendid birds to breed from, no matter whether the soil is wet or heavy, and they do well when they have a free range. At the present day no breed of fowl is used more for crossing with mongrel hens and pure birds of other varieties than Orpington cockerels."

I have already said and shown that the fanciers in England received the new breed with anything but enthusiasm. Mr. Cook was not a fancier in the general acceptation of the term, neither was he an exhibitor; and any poultry production emanating from any source but these was regarded with suspicion; hence when the single-comb, clean-legged black fowl was spoken or written of as a "new breed," the matter was pooh-poohed, one contributor to the papers at that time going so far as to describe them as an imposition, and now at the close of a nineteen years' experience, and at the height of popularity, these same fanciers are wondering at themselves for their then opposition, and this opposition can be rightly wondered at, seeing that but a few years before the English fanciers received with open arms from America, first Leghorns, then Rocks and Wyandottes, and although the two latter breeds were justly spoken of "as the best all-round fowls," still, for commercial purposes in England, both had the handicap of yellow legs, with the too frequent accompaniment of yellow skin, while the skin of the abused Orpington was as white as that of the much-favoured average Dorking.

A recent writer on this subject of English home manufacture thus puts the matter. "It is from America that most of the new varieties of fowls come. American efforts in this direction have been by no means wanting in success. Witness the several sub-varieties of Leghorns, the now popular Plymouth Rock, and Wyandotte. An English fancier occasionally makes an effort to strike out in a new line, but whatever may have been the case some forty years ago, when the fancy was comparatively in its infancy, there is no doubt that now-a-days, the attempt made to bring forward new breeds of home manufacture do not meet with much encouragement. From the point of view of the fancier, there is plenty of room for new varieties, especially in the utilitarian sense, provided they be distinct and sufficiently established not to betray the original elements from which they were manufactured. It is probably on account of the premature way in which the results of English attempts to form new breeds have been brought forward that they have failed to attain anything like the success of imported specimens of manufacture. We have also a national prejudice in favour of being imposed upon, and just as we accept American bacon more readily when it is labelled 'Best Limerick' and sold at a high figure, than when it is truly described

and priced accordingly, so we much prefer to be told that our new varieties of poultry are descended from birds imported from some unknown region, rather than learn the truth as to the elements from which they were formed."

In relation to the Orpington opposition, the truth of the closing sentence of the above quotation will be apparent, and there is not a doubt but had the originator maintained an air of mystery in connection with the component parts of his new fowl, its popularity would have been earlier assured. However, this opposition was little heeded by Cook; he continued on his course of poultry-breeding for profit, lecturing, and otherwise propagating the new poultry gospel, advocating improved methods in the industry, and pleading with his audiences and the public to give the new breed a trial; and as the majority of those who attended his lectures did so with the purpose of receiving instruction in the way of better-paying results, and to that end were influenced in favour of the new breed, and of the many hundreds of letters published on the result of these trials in the early history of the Orpington, the vast majority was in laudatory terms of its superiority. These unsolicitated testimonials from ordinary poultry-keepers to the merits of the new breed, soon brought conviction to the fanciers that there was something in them after all, and as the fancier who goes in for a new variety in its early history usually makes the most money out of it, so it was with the Orpington; and as an occasional setting of eggs or trio of these birds from Cook got into a few fanciers' hands, there was soon application made to the societies for classes for the new production. Their appearance in competition for a year or two was confined to the variety class, but their rapid spread throughout the country amongst all classes of poultry-keepers, obliged the societies to make provision for this variety in their schedules, and they have now for a number of years become a recognised breed with agricultural and fanciers' societies alike. The Orpingtons already referred to are of course the Blacks, and the character given to them by the originator and testified to by thousands of breeders almost precluded the thought that any further inventions in the way of breeds or varieties would ever again come from that quarter. The birds were as near perfection as reason could expect, and were, as Mr. Cook said, able to withstand the hitherto ill-effects of the show-pen. However, the originator, seeing the popularity which his birds were attaining in the exhibition world and the fancy price which show-pen specimens realised, in addition to his utility propaganda, became an exhibiting fancier as well, and once he entered upon this course, it was no surprise to hear that other varieties of Orpingtons were in course of manufacture. These have duly appeared, and like the Blacks became widely distributed, one colour at least—the Buffs—for a time threatened to overshadow the originals; however, the past two or three years, patrons of the Buffs are on the decline, and there is now scarcely a doubt that if Orpingtons continue for all time to occupy a place in domestic poultrydom, Blacks will be found in the chief position. The Department's artist has been happy in portraying a typical Black Orpington cock in the September

Gazette, and a hen of the same breed in the October number, these and the standard for judging, which appear later on, will enable the breeder to realise how near exhibition requirements their stock is, and perhaps save the novice from the disappointments of the show-pen, by enabling him to detect the shortcomings of his fowls in that respect.

CHAPTER XIX.

White Orpingtons.

The success of Cook's first experiment in fowl-making, as can be readily imagined, prompted him to further efforts, which resulted three years after the production of the Blacks, he, this time, going to the other extreme in colour; the due arrival of White Orpingtons in 1889 fairly astonishing the poultry fraternity. The explanation, or apology for the Whites is not very definite, but is embodied in the following:—"I proceeded to produce, as far as possible, an ideal set of breeds that would do great things for the poultry-keepers of the present and the future," consequently Whites are one of this set, and the method of their production is as follows, in Mr. Cook's own words:—

"I had made many experiments to find out the best method of producing white fowls that were up to date. I began by crossing the White Leghorn cocks with Black Hamburg hens, and the pullets from this cross came every one white. I next used a rose-comb White Dorking cock, mated with the offspring from above, and some of the birds came blue, some barred, like Cuckoo Dorkings, and it was a long time before I could produce pure white birds. But with careful breeding, the rose-combed White Orpingtons were made intoabreed which produces quick-growing, vigorous birds, with good laying and table qualities; they have taken wonderfully, and poultry-keepers have found them lay more than any other white breed—245 and 250 eggs each a year some specimens have produced, and others have laid 190 eggs in the same time. They are splendid table birds, have white skin and legs, and this is a point with English people. Then the single-comb White Orpington was produced by using a single-comb White Dorking in place of the rose-comb. There is the same difficulty with these birds as there is with all other white varieties—that is, although they do well in confined runs in town, the plumage shows the dirt, and never looks bright. As layers they can hold their own with almost any other breed, the eggs being of a cream colour, and of a good size. The chickens grow remarkably fast, and feather as quick as young partridges. The cockerels can be killed at an early age, and their skin is as white as that of a Dorking, and the legs the same colour; the pullets will lay at five months old, but most of them are in full lay at six and a-half months old. The cocks are splendid for crossing with White Leghorns, Light Brahmas, or White Dorkings—that is, if the owner wishes to keep his stock birds white, and yet does not at the same time wish the laying qualities to go down. It must be understood that new breeds are usually excellent

layers. We do not remember hearing of a single complaint of bad laying results from the White Orpingtons; and this is most encouraging, as we have aimed at producing birds of utility rather than a fancy breed, which in the future will indeed be the leading feature of all breeds, which are preserved to posterity. Leghorns have, of course, been looked upon as the best layers, for a great number of years, but Orpingtons have come in and taken their place very largely, and in the future are likely to do so increasingly, as the White Orpingtons have surpassed them generally, because, whilst possessing splendid laying results, they are also excellent table birds. This, of course, makes the Orpingtons more valuable. The great difficulty in connection with the small breeds, like Leghorns, consists in the fact that there are always a large number of cocks to be sold, or killed for table. These being small birds, of course, realise less than the White Orpingtons, which are good layers, and as fine table birds as they are layers. Then, again, this rule holds good where crosses are kept, for the cross-breds are finer and just as prolific layers as well."

So far as White Orpingtons in this State are concerned, they have made but little headway. Four or five years ago Mr. J. E. Pemell, of Randwick, Mrs. Ewing, of North Sydney, and Mr. J. McComb, of Manly, exhibited a few at several of the Sydney shows, but speaking generally, they have not prospered, and are now rarely seen. At the same time they are becoming most plentiful in England, and have been exhibited in large numbers during the past year at some of the best shows. Some importations of this colour lately arrived in South Australia, from Mr. Cook's yards, and from correspondence I have seen in connection with them the birds appear to be superior in size to those exhibited here; however, seeing that we have White Leghorns, and White Wyandottes in abundance, it is scarcely likely that Orpingtons of this colour will ever become favourites here.

CHAPTER XX.

Buff Orpingtons.

Seven years ago, when writing in the *Gazette* on Profitable Poultry-keeping, I mentioned that fashion had a good deal to do with the popularity of breeds or varieties of poultry. For a number of years one breed will take the public taste, then another will be in the ascendency; following this some old breed may be resuscitated, as in the case of the Old English Game at the present time, and displace some of the newer breeds. Then a particular colour of one or all the breeds may become fashionable, the bulk of the fanciers for a time patronising this fashion until something new appears. In the article in question I mentioned that the buff colour was the fashionable one, Buff Leghorns, Buff Langshans, Buff Wyandottes, Buff Rocks, and buff of other breeds, all having a call. William Cook was business man enough to take the tide at its flood by manufacturing a Buff

Orpington, and sure enough it led on to fortune. The Blacks were exactly nine years on the markets when Cook placed the first pair of Buff Orpingtons in the Dairy Show in 1894, and so great was the run on them, that before the end of the season he had disposed of 400 settings of eggs, and in the first year sold over 200 stock birds of this variety.

Writing a year later on the subject, Mr. Cook said :—" No variety of fowls up to the time Blacks were brought out ever took so well in England as they did, but the Buffs have sold off quicker in the time than even the Blacks. Some people may say: Why bring out the Buffs when the Blacks do so well—is it not overdoing it? Not in the least. No one ever complains of a florist bringing out new flowers, particularly if the colour is more attractive than that of the old varieties; so it is with the Buff Orpingtons. In introducing the Black and white varieties, I told the people how they were made, and I will do the same with the Buffs. First I mated a Gold-spangled Hamburg cock with a coloured Dorking hen of good size, and from the best laying strain obtainable; these produced pullets of a reddish-brown colour, which I mated with a Buff Cochin cock. Hamburgs are excellent layers, but rather delicate to rear as chickens. The Dorking is a splendid table bird with a very long breast, and when crossed with the Hamburg will produce wonderful layers."

As already said, Buffs were brought out in 1894, the originator anticipating such a demand that in 1895, 1,000 chickens of this variety were reared at Orpington House, the craze for them being that long before the close of the year every bird for sale was disposed of, the majority of them being dispersed throughout England, large numbers of them also going to South Africa, Canada, United States, New Zealand, and Australia; while in the early months of 1896, foreign orders to the extent of £1,000 were received. This extraordinary demand I have attributed to a craze, for the simple reason that the time this variety had been before the public was insufficient to warrant any definite statement as to their merits. However, as time went on, testimonials increased, and by the end of 1896 they were overtaking the Blacks for popularity. The extraordinary rush on or for this new variety being even a surprise to Mr. Cook himself, who in attempting to explain such, said :—" One reason why Buff Orpingtons have taken so well this past season, is because of their quick growth. This got talked about, and was an inducement to many people to go in for eggs who would otherwise not have done so. Buff Orpingtons, besides being good layers, are excellent table birds, and although they do not all come true to colour for exhibition purposes, they can be sent to the London market or utilised for one's own table. Another reason why so many took to them was because they were so good winter layers. In Sussex and Surrey they are used very much for turning down in farm-yards with mixed lots for improving the laying and table qualities, and these have done good service in this direction, and where birds are not perfect specimens, are very useful for the purpose mentioned, and are used largely by poultry-keepers for improving their stock, as they can be bought at a low price and are as good as the

best for that purpose. Farmers and others have done very well by using them as they have, because the pullets have laid before they were six months old, and gone on for a long time, thus proving the laying and table qualities."

Earlier in these articles I have referred to the spleen shown by a few of the old fanciers against the Black Orpington in its early history, but as this had almost disappeared on the introduction of the Buffs, it may be thought that they, realising the triumph of the former variety, would pause before uplifting their voice against the latter; but this was not to be, all the old rancour was revived, while prominent breeders who had allowed the Blacks to come and conquer without resent appeared in force against the latest innovation—the Buffs. This policy was rightly described by Cook as the violent and virulent opposition of the old-time enthusiasts, who, dog in the manger like, would rather waste opportunities than let others, better capable of supplying birds for the times, carry on their benevolent work, and when the new breed appeared an outburst of nonsense hailed their introduction until he had to meet arguments which were as foolish as they were spitefully ingenious and as harmful as they were erroneous. How far they succeeded the popularity of all the varieties of Orpingtons to-day is a fitting reply, and, so far as the Buffs are concerned, Cook's prophecy in 1898 about them becoming as numerous as the Blacks was first overwhelmingly demonstrated at the Dairy Show in 1902, when black cockerels numbered 35 entries and pullets 43, buff cockerels had 47, and pullets the extraordinary number of 73.

In England, and of late years in a small way here, when any breed of fowls has become at all plentiful among fanciers a club is usually formed to assist in developing it by providing special prizes, securing competent judges, and otherwise framing regulations in the interests of the breed concerned. These clubs when conducted with discretion are of much value, but when personal interests or dictatorial conduct of any kind is allowed to creep in their usefulness is to be questioned. Black Orpingtons, like other varieties of fowls, had soon an organisation of this sort formed by a few of its earlier admirers. At an annual meeting which was held at the Holborn Viaduct Hotel, London, on the 20th January, 1895, there were eighty-four members on the roll. The Buffs had then been a year before the public, and the recruits to this new colour, thinking that the club could much enlarge its usefulness in embodying the Buffs in their constitution, made a proposal to that effect, but such was not to be, the following paragraph appearing in their annual report:—"The club view with strong disfavour the introduction during the past year of the so-called White and Buff Orpingtons, which are not allied to Orpingtons in any respect whatever." And before the meeting closed the following resolution, moved by the president, General Gillespie, was put and carried:—"That the club view with dissatisfaction the providing of classes by show committees for other than Black Orpingtons, and the club hereby refuse to grant medals or specials for any than the variety recognised by it." And, as showing the tyrannical nature of some of these clubs, a 10-guinea special challenge cup was offered by the president and

accepted, one condition of the competition being "that it was only open for competition to those who had never exhibited Orpingtons other than black."

The resolution adopted by the meeting in question much affected Mr. Cook, who took umbrage at the club referring to the new variety as so-called Orpingtons, and in the following issue of his poultry journal gave his opinion on the attempted boycott:—"As I am the originator of the Orpington fowl," he begins, "I think it only fair that I should be allowed to make a few remarks upon the report. When I bring out a breed of fowls, I always let the public know what blood is used to produce it. When some Americans bring out a new variety they give the best side of the birds, saying nothing about whether they breed true to colour or have any other failings—they leave the public to find that out for themselves. What first induced me to bring out Orpingtons was seeing the Americans bringing out new breeds or varieties, and the English people taking them up, in many cases paying very large sums of money for good specimens. I could see no reason why some of that money should not be kept in England —in other words go into the Englishman's pocket as well as the American's. I knew quite well we had many breeds in this country which could be blended together to produce a new variety as well as the Americans, in fact, we have better breeds to select from, for the Americans have never brought out a fowl equal to the Orpington, in appearance, winter laying, and table qualities combined. As I had been trying experiments for many years in crossing and re-crossing, I knew exactly what breeds to use to produce such birds, and I am pleased to say that my efforts have not been in vain. I do not say a word against any of the breeds the Americans have produced, but I do want to ask why we should pay such enormous prices that in many instances have been paid to the Americans, when we can produce quite as good, if not better, ourselves. No one complains that we have too many varieties of flowers, yet we are constantly having fresh sorts introduced. As long as they are pleasing to the eye, and superior to the old ones, people admire them, and buy them at the same time. It is only a few old breeders who have not yet got quite out of the roads our grandfathers travelled in, and some others who are jealous of the success the Orpington has met with, that speak against these birds. I do not wish to boast of my success, but I am thankful people have taken the breed up in the way they have done."

With the above plain statement of facts in 1895, and the since unprecedented success of the variety as already noted, it would naturally be supposed all opposition would have ceased. It, however, did not, for within another year or two a most acrimonious correspondence arose over the breed. The opposition this time going so far as to question the veracity of Mr. Cook as being responsible for the manufacture of the variety, they asserting that the breed was nothing else than an old buff fowl common in two or three English counties, and known as "Lincolnshire Buffs." Messrs. Lewis Wright, E. Brown, F.L.Z., Harrison Weir, and a number of other poultry

authorities all joining in describing the birds as nothing else but an ordinary buff farm-yard fowl largely bred in Lincolnshire.

The correspondence on this subject would fill an entire *Gazette*, but having gone carefully through every line of the discussion, it is not difficult to arrive at a conclusion as to which side the preponderance of evidence rested, suffice here to say the continued popularity of the Buff Orpingtons, and their acknowledged excellent qualities is a complete justification for their introduction from whatever source; while for Lincolnshire Buffs, which were rarely heard of in the poultry press prior to 1894, they have now emerged from that obscurity which in the absence of the discussion they were destined to remain, and as Buff Orpingtons are now popular here, I have considered it right to briefly record the story of their rise and development, together with the formidable opposition they encountered in the early years of their history.

CHAPTER XXI.

Jubilee and Spangled Orpingtons.

Hitherto the productions in the poultry line, which emanated from Orpington House, although of several colours, were but self colours, namely, blacks, whites, and buffs, and of these, two varieties each, single and rose-comb. These, however, did not satisfy the originator, who, ever fertile in resources in the way of producing type and colour in order to secure an ideal, now proceeded to invent another variety composed of several colours. Mr. Cook said, he had been making at these for a number of years, and first placed them before the public in 1897—Jubilee year—and named them Diamond Jubilee Orpingtons. Her Majesty, the late Queen, the same year adding a breeding-pen of this variety to her large collection of prize poultry. Mr. Cook wrote of them as follows:—"The rapid spread of the new breeds has been the wonder of the poultry world, and, as one after another of them has been launched and absorbed by the great army of breeders, and splendid classes, well filled, have appeared at the various shows, the voice of controversy, which at one time meant only the voice of derision, has changed into one of praise and admiration. Nothing succeeds like success, and Orpingtons have succeeded, but the Diamond Jubilee Orpingtons have succeeded in a way peculiarly their own. Those who have tried them as table birds, say they have never eaten such splendid fowls, and we are not surprised, as they have been bred in such a way as will ensure this, and they will become better if they are carefully bred. The laying qualities of these birds are also very extraordinary; some that were hatched in February were laying in August, while the March and April chickens were laying in early September, and these laid all through the winter, some averaging 100 eggs up to the end of February, by the time they were twelve months old. The chickens grow as fast as any other of the Orpington varieties, indeed, these and the Buffs grow, if anything, faster than the Blacks. We have had a run on the cockerels, as these are found especially

valuable for crossing in the farm-yards, and this is a valuable feature of the influence these birds are introducing into the already improved condition of things among the farmers' fowls."

In a communication I received from Mr. Cook, in April, 1899, he stated that the Jubilee fowls were then very popular in England, on account of their wonderful laying qualities, and handsome plumage. The first Jubilees to reach Sydney was in December, 1899, a trio each, arriving to the order of Mr. Hayes, then of Epping, and a trio to the writer, one hen of the latter being still alive, now seven years of age. Following these were a shipment to Mr. Gillham. The above constituted the bulk of the stock in Australia until the following year, when the originator visited Sydney, bringing with him about thirty of the breed. This variety for two or three years did remarkably well, large classes of them appearing at the Royal and other Sydney shows; but during the past year there has been a serious decline in their patrons. Strange to say, however, in Victoria they have quite a number of admirers, and are spoken of there as excellent for the export trade which, as in other parts of Australia, still hangs fire. When the Jubilees were produced many thought the Orpington family was complete. Not so, for on Mr. Cook's visit to Sydney together with the Jubilees, a number of a spangled variety arrived. These were black and white, much like the Houdan in colour. The birds found new owners, but were a less success than the Jubilees. This then, closes the historical portion of the Orpington fowls, but not all the Orpington productions, waterfowl, like the other poultry, being honoured by the addition of a couple of new breeds to their rather limited family. The Blue Orpington Duck was put on the market in 1895, and reached Sydney a year later, and the Buff in 1897. The only reference of importance in connection with these is confirmatory of Mr. Cook's statements as to their merits. The Editor of *Poultry*, early in 1898, visited Orpington House, and in his report said:—"Of the ducks mention must be made of the Blue and Buff Orpingtons, two varieties made by Mr. Cook in recent years: the former combining the necessary qualities for table purposes, of quick and large growth, together with being good layers, while the Buffs are specially valuable as layers. These ducks have 'caught on,' as the saying is, and numbers have been exported to the colonies."

The photograph of the Orpington duck, taken by Mr. Grosse, early in 1899, and which illustrated the Orpington article at that time, shows the great size spoken of by the originator, while the records made at the two Duck Egg-Laying competitions testifies Mr. Cook's statement that the Buffs are specially valuable as layers.

(*To be continued.*)

Bees: Are they Friend or Foe?

ALBERT GALE.

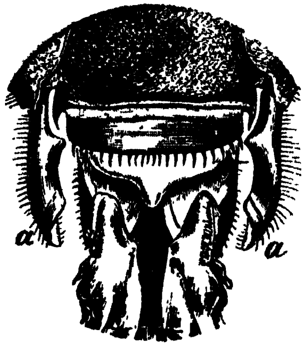
"APIARISTS generally acknowledge that among the family of bees the Italian variety takes a high place for industry. From reports received by the Lands Department, however, it would appear that these bees collect their honey at considerable expense to orchardists. An application has recently been received by the Department for the lease of a bee-farm allotment in the Western district. This application is opposed by the adjoining farmers. A Crown lands bailiff, who reported on the subject, said that one orchardist in the locality estimated that the damage caused by Italian bees in his vineyard meant a loss of twenty barrels of wine, in addition to a large number of soft-skinned peaches. These bees, it was said, should not be permitted, except in back country away from orchards. Mr. Murray is at present engaged in the preparation of a Bill dealing with the whole subject of apiaries."

The above paragraph is an extract from *The Australasian* of 16th September, 1905. Why the Italian variety of the honey-bee should be selected as the criminal of the bee family is, I suppose, because she is thought to be more industrious than her less gaudy sister, the black bee. So it appears from the above paragraph. This is still a disputed point with some bee-keepers; be that as it may, the subject should not be passed over by either bee-keeper or orchardist without serious reflection. Let us look at it and see how far these poor bees deserve the indictment levelled against them.

Some entomologists have divided the insect-world into two great divisions, lapping and gnawing, *i.e.*, insects whose mode of feeding is by lapping their food with the tongue, and those that use their jaws mandibularly, like the method of feeding by quadrupeds. The honey-bee was classed with lapping insects. I am not going to assert that the honey-bee has not the ability or power to gnaw. I know they have; but it is most exceptional for them to use that power other than in their domestic economy. The structural formation of the mouth of the Italian bee is precisely the same as that of the English, or black, bee; therefore the one is not more detrimental to fruit culture than the other—that is, if either of them are. It appears that an application has been made from the Western district of Victoria for an "allotment," and "this application is opposed by the adjoining farmers." By farmers, I suppose, is meant agriculturists, men who are chiefly employed in the culture of cereals. If such be the case, therefore, farmers in general and those above referred to have nothing to complain of at the introduction of the honey-bee into their districts, because bees do not work on cereals, either detrimentally or beneficially. The crops of wheat, maize, &c., are not fecundated by the aid of the bee,

or, indeed, any other species of insects, but by the wind or some other agitating agent that will shake the pollen from the stamen (male flower) to the stigmatic portion of the pistil (female flower). Therefore the question, as far as it affects farmers, may be here dismissed.

It is otherwise with orchardists and vignerons, because insects play the most important part in the production of their crops, and are the agents that are employed by Nature to carry the pollen grains from the stamens to the pistil. Every grain of seed within an apple, orange, grape, peach, pumpkin, and, indeed, all seeds that are fructified by insect-agency, require a pollen grain before the seed can become fruitful. In the above paragraph the charge brought against the Italian bee is that she has been the cause of the "loss of twenty barrels of wine," besides destroying "a large number of soft-skinned peaches." Does she deserve such a character? I have shown that honey-bees belong to the sucking or lapping insects, and that their mandibles are not formed as are those of the leaf-cutting insects or those that are carnivorous. The mandibles of these



(*a a*) The Mandibles of *Apis millifica.*

b

(*b*) A Mandible, showing the cutting edge.

latter are more or less saw-like, deeply toothed for the purpose of cutting the material of which they construct their home, or of carving the food upon which they subsist. The mandibles of the honey-bees have knife-like edges, and are worked by the insect like a pair of sheep shears. From this it must be apparent that bees have some difficulty in taking hold of the smooth skins of grapes and other fruit. That bees are seen by the thousands in orchards and vineyards when the natural honey-flow fails is true, and that they do obtain food from the fruit, I will not dispute; but that they were the first aggressors I do dispute. During last autumn I noted grape-vines that were swarming with bees, and in no case did I see them make the first puncture. Grapes with skins intact have again and again been placed near to an apiary to test if the bees were guilty of the charges laid against them. Not till the fruits are punctured do bees attempt to rob the vignerons of their wine.

Fruit-eating birds commence the destruction; then because the bees are found sucking the juices through the puncture made by the birds, they are charged with the first offence.

But let us suppose the charges are all true that are brought against the bee, and that legislation be brought in to prevent the bee-farmer from pitching his tent too near to the farmers and orchardists—*i.e.*, he must not come within a radius of from 3 to 6 miles to civilisation, for bees in their peregrinations have been proved to travel those distances. Let those who complain of the destruction caused by bees smear the trees with poisonous honey and burn down the trees where there are bees' nests, and depend for the pollenization of his crop to beetles, moths, butterflies, &c., for these and others are used by Nature as pollen-carriers; nevertheless, they are not nearly so successful in "setting" the fruit as the despised honey-bee. What will be the result? I wonder which the orchardist and vine-grower prefers—a swarm of bees sucking the juices from his fruit that has already been destroyed by birds, or swarms of caterpillars destroying the foliage of his vines and fruit-trees. He must have one or the other. Butterflies and moths lay their eggs on the foliage of the trees on which the caterpillars feed. Bees do their work of increase in the hives at home. The advent of a bee-keeper in a fruit-growing district is a blessing, not a curse. Fruit-growers and bee-keepers form a mutual provident association. So strongly are they united, that to repress the former is to largely destroy the profits of the latter. Fruit-growers should have the words "No Bees, no Fruit" framed and glazed and placed in the most conspicuous place in the house. Many an orchardist has, by the destruction of bees, learned a lesson that he will never forget.

Bees and Grapes.

"It has been pretty well established that bees never touch the perfectly sound fruit (grapes)." "Until recently it was supposed by all fruit-growers, and even by some bee-keepers, that bees made a small round puncture through the skin of some soft grapes." "Recently we were successful in finding the real culprit, and that was in the form of a little bird, the Cape May Warbler." "Birds are scarcely ever caught in the act; the bees, ever present during all the hours of daylight, receive all the credit for the mischief."—*Extract from "Roots A.B.C. of Bee Culture."*

[In the year 1897, several articles from Mr. Gale's pen appeared in the *Gazette* on the influence of Bees on Crops. It would be as well to read those articles in conjunction with this.—Ed., A.G.]

Forestry.

Some Practical Notes on Forestry suitable for New South Wales.

[Continued from page 898.]

J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

XI.

Grazing in Forests.

Speaking broadly, we may say that the grazing interest is antagonistic to the forest interest. Goats should never be tolerated in a forest under any circumstances, as they absolutely destroy the young growth as far as they are able. Sheep, cattle, and horses do harm in varying degrees, not only by eating out the tree seedlings, but by trampling and hardening the soil, and also by forming tracks which are accentuated by the rain and form fissures and landslips. Cattle do least harm, as they usually confine their attention to the grass; calves are more frisky, and do harm by running and jumping about, and also by gnawing young trees to a much greater extent than they do when they get more staid in their habits. Horses do much harm to a forest. On the other hand, animals eat much grass and inflammable weedy plants and rubbish; thus they reduce the risk of fire in the forest, and the pasturage as such has a greater or less value.

From special areas where there is, for example, a growth of many young seedlings, stock should be rigorously excluded; but as regards forests in general, it is idle to propose to exclude them altogether. The proper forest policy should be to regulate the grazing. A proper code of forest grazing regulations will, in the course of time, be promulgated by the Forest Department.

It is quite a mistake to suppose that the running of sheep, cattle, and other grazing animals in forest lands is peculiar to Australia. In Europe, in spite of the forest regulations and forest practice which has grown up for centuries, much harm is done by grazing animals in many of the forests. The whole subject is gone into very exhaustively in a very readable chapter* of Schlich's work. The whole matter has to be arranged with a view of balancing the conflicting interests—that is to say, to conserve those of the trees, and at the same time to obtain a maximum revenue from the grass and other forage plants.

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* Chap. ii. Vol. v (W. R. Fisher) of Schlich's "Manual of Forestry"; see also Ribbentrop's "Forestry in British India," p. 160.

In New South Wales cattle are freely admitted into the forest reserves; in the central and western divisions sheep freely traverse such areas. A few years ago Parliament voted a large sum of money for forest-thinning, but during the late drought the return was not so much from the improved growth of the trees as from the improved value of the grasses and other fodder plants within the areas. I believe, therefore, that the country obtained a fair return on the outlay, but what amount of improvement was shared by the trees I am not in a position to say.

In many countries grazing animals are driven from their exhausted pastures in the plains to the succulent herbage of mountain country. For example, the sheep of Lombardy are driven to the Tyrol, those of certain plains in the United States into the high mountain ranges a few miles distant.

In our own State, the best instance we have is where the sheep of the Riverina are sent, in the summer, to feed on the Mount Kosciusko plateau, the rolling grass lands there, with their rich succulent herbage, being apportioned into what are known as snow-leases, from which a certain amount of revenue is obtained. The regulations in force on our snow-leases are very easy, and, consequently, in some years, a good deal of "burning-off" goes on.

In the Western United States the mountains are higher than with us, and an enormously greater area of country is available. It is interesting, however, to note the regulations adopted by the United States Government in regard to these lands. The key-note of these regulations is effective, yet non-harassing supervision of these grazing forest reserves. It is certainly not in the interests of the forests to allow unrestricted grazing, and it should be brought home to the grazier that he is killing the goose with the golden eggs in not loyally co-operating with the forester. In this State every encouragement should be given to the "reasonable" grazier, and disloyal ones should be visited with sufficiently severe disabilities. In passing, it may be observed that forest officers in all countries have the supervision of grazing land more or less associated with forests.

The following principles, announced by the Secretary of the Interior, form the basis of all grazing regulations in the reserves.* The central idea is co-operation between the Government and the grazing interests in securing the best management and bringing about the best condition of the range:—

(1) The Government, through its forest officers, after consultation with the representatives of the various interests involved, should decide on the number of head to be grazed in each forest reserve, and should establish the boundaries between cattle range and sheep range.

(2) The local association should assign ranges to owners within the limits thus laid down, subject to official approval.

(3) Both owners and local associations should be held responsible for the observance of the terms of permits and the prevention of fire and over-grazing.

(4) Each sheep-owner should have the exclusive right to his range (lease), and the same should apply within reasonable limits to groups of cattle-owners.

(5) Permits should run for five years.

* Filibert Roth, "Grazing in the Forest Reserves," Year-book, U.S Dept. of Agric., 1901.

(6) Residents should have precedence in all cases over tramp-owners and owners from other States.
(7) Local questions should be decided on local grounds and on their own merits in each separate case.
(8) Since the forest reserves are usually summer ranges, provision should be made for necessary routes of transit.
(9) The policy of the Government should be based on regulation rather than prohibition, except in special cases, it being understood that the avoidance of overgrazing is equally in the interests of all parties.

These permits are granted free of charge. The number of animals is limited, and the time of entrance into and exit from the reserve, as well as the district where they are to graze, is decided by the Department of the Interior.

In carrying out these principles the rules now adopted are:—Wherever an association of sheep men exists, which represents the majority of those who have, for at least two years, used the reserve pastures, such an association is recognised. Blank applications are sent to the secretary of the association, and he distributes them and gets them filled and signed. He then transmits them to the supervisor, and the latter to the Department, when permit is issued. To set forth more definitely the requirements of the Department and the conditions of such a permit, the following appears printed on every application and permit:—

This application is also made with the understanding, and full agreement thereto, that penalties will be imposed for a violation of rules as follows:—

Permits cancelled and refused.

(1) For obtaining or attempting to obtain a permit on false representations.
(2) For wilful trespass upon areas where not permitted, either on closed areas or ranges of others.
(3) For setting out fires to clear range.
(4) For *wilful* negligence in leaving camp or other fires.
(5) For refusing to observe promptly any direct order from the Department requiring an observance of any rule.

Other Penalties.

The number of sheep covered by a permit to be materially reduced for the following stated causes, viz.:—

(1) For crowding on to a neighbour's range without the consent of the said neighbour.
(2) For bedding sheep more than six nights in succession in any one place, except when bedding bands of ewes during lambing season.
(3) For entering the reserve prior to the date authorised.
(4) For remaining in the reserve after the permit has expired.
(5) For corralling (yarding) within 500 yards of a running stream or living spring.
(6) For gross carelessness in leaving camp fires.
(7) For failure to aid in extinguishing a fire occurring within the range occupied when possible to do so.
(8) And for such other minor violations of the rules as may occur.
(9) For failure to remove sheep promptly, upon order of forest officer, when damage is being done to the range
(10) For failure of herder to corral for count, upon order of forest officer or ranger, when number of sheep appears to be greater than the number covered by permit.

I also agree to forfeit the permit for a violation of any of its terms, or of the terms hereof, or whenever an injury is being done the reserve by reason of the presence of the animals herein.

The next Part will take cognisance of the Sylvicultural Conditions of New South Wales.

(*To be continued.*)

Quantitative Estimation of Bunt in Seed-wheat.

N. A. COBB.

In the July number of this Gazette, 1904, in an article entitled "Quantitative Estimation of Disease Spores," I called attention to a useful application of the ordinary physician's centrifuge in estimating the degree of fungus infestation as indicated by the spores present in certain cases, taking as an example one of the commonest of the diseases of wheat, namely, bunt.

It was shown that the ordinary method of counting blood corpuscles is directly applicable to a number of fungus diseases, and that, in the case of the bunt of wheat, the centrifuge would indicate the presence of an amount of smut on the seed that would completely escape detection by any other known method.

In the following pages the results of further inquiry in this direction are recorded, attention being confined to the bunt of wheat.

Mr. R. W. Peacock, Manager of the Bathurst Farm, prepared a standard sample of bunted wheat. The sample submitted by Mr. Peacock bears the following label:—"Bathurst, 13th January, 1905. Seed from 1,000 plants of Cumberland wheat, each plant averaging six to eight heads. The plants were put in sheaves of 100 plants each. One bunted, ripe, full-sized head was placed in the middle of each sheaf, and the whole threshed in the ordinary way."

This sample of seed was centrifugalised in the manner described in the article referred to above.

One thousand grains of the 2·75 mm. grade were taken by count and placed in a glass-stoppered bottle freed from spores. Fifty cubic centimetres of spore-free water were added, and the bottle shaken for one minute. The water was then immediately poured into four centrifuge tubes through a brass-gauze sieve of one hundred meshes to the inch. The four tubes were centrifugalised for one minute at the rate of 3,000 revolutions per minute.

This settled the bulk of the spores to the bottom of the tubes, leaving the water comparatively clear. This clear supernatant water was immediately poured back into the bottle with the wheat and used to wash it a second time, the shaking being continued for one minute as before. This water was then poured back into the centrifugal tubes through the brass gauze.

The four tubes were now centrifugalised for three minutes, at the rate of 3,000 revolutions per minute, after which the water appeared fairly clear,

the sediment being collected in dense masses at the bottoms of the tubes. From each tube all but about 2 cubic centimetres of the water was poured away, and all the sediments placed in one tube. The cleared water was used to rinse the three tubes as they were emptied into the one. Furthermore, the cleared water was used to balance the tubes containing the spores—what was supposed to be all of them. The object of using this water for this purpose was to *test its condition as regards spores.* The two tubes were now centrifugalised for three minutes. As a result all the spores were supposed to be collected at the bottom of one tube. If, however, it should prove that three minutes had not been sufficient time to settle all the spores in the first instance, some of them would appear at the bottom of the check tube used as a balance, for this water would now have been centrifugalised twice. It may be stated here that the slight sediment in this check tube contained no spores. Apparently the spores were so heavy as to easily settle under the amount of centrifugal action mentioned.

The tube containing all the spores collected from the 1,000 grains of the standard sample of wheat was now emptied of fluid, except for 1 cubic centimetre at the bottom, together with the sediment, of course, and this latter was thoroughly roiled up by the use of a long and pointed medicine dropper or pipette. The roiled fluid was placed in a cell one-fifth of a millimetre deep, and the spores counted under the microscope on a network ruled to ½-millimetre squares—*i.e.*, into squares having an area of one-fourth of a square millimetre.

Four observations of ten to twenty counts each gave the following as the number of spores on one of the squares:—

12·05
14·40
11·40
13·60
12·86 average.

This gives 51·45 spores on each square millimetre, and, as the cell was one-fifth of a millimetre deep, 257·27 spores to each cubic millimetre, or 257,250 spores in the cubic centimetre, in other words, from the entire sample of wheat. As there were 1,000 grains in the entire sample, it follows that if the spores were evenly distributed there were about 257 *washed from each grain.*

It is now instructive to consider once more the nature of the sample of wheat which was thus tested. As Mr. Peacock's note indicates, the sample was a standard sample, perhaps the first ever so prepared. Among about 700 heads (Mr. Peacock mentioned sheaves of 100 plants averaging six to eignt heads each), one full-sized bunted head was placed, and the ten sheaves of this nature were threshed "in the ordinary manner"—that is to say, in the maner usually practised at the Bathurst Experimental Farm. It may be taken for granted that the machinery was typical machinery, and that if the same sample had been threshed at another farm the results would have been about the same, though, of course, some variation would occur.

It is known that a bunted plant produces about the same number of heads as it would had it not been attacked by the disease. From this it follows that Mr. Peacock's standard sample corresponds to one plant of

bunted wheat among about 700 sound ones, since to keep the proportion of plants he would have had to add seven heads to the 100 plants instead of, as he did, a single head.

We must next consider the state of the threshing machinery. I think it may be taken that the machinery was cleaner than would ordinarily be found at work in this State. The Bathurst seed is well known to be clean seed, and the machinery, while it could not reasonably be supposed to be absolutely free from bunt spores, must be above the average in that respect. I have had occasion to examine threshing machinery with reference to its cleanliness, and have no hesitation in saying that, as a rule, our machinery is something of a failure in this respect.

Hence it may be taken as fairly well established that the sample tested for its bunt infection, had it originated in the ordinary manner, would have been at least as fully infected as proved to be the case, namely, at least 257 spores to each grain of wheat.

It should here be noted that in all probability more spores could have been washed from the sample, but this additional number would not have been a large one. According to previous experiments detailed in the article on "Quantitative Estimation of Diseased Spores," the number that could be secured by further careful washing might reach about 10 per cent. of the number obtained by the method adopted. The reason for stopping after two washings was this: For a practical test of this nature, it would be necessary to draw the line somewhere, the labour of complete washing being such as to materially increase the cost of the test.

It is quite possible that in the end it may prove to be best to wash three or four times, instead of only twice. In the present instance, time was an important factor. Furthermore, it was thought best not to spend too much time on the test until its efficiency was more fully demonstrated.

As before remarked, water that was centrifugalised six minutes gave no additional spores, so that it may be taken as proved that three minutes in the ordinary centrifuge at 3,000 revolutions per minute is a sufficient treatment.

It is best not to lose sight of the fact that a perfectly clean sample of wheat put through an ordinary threshing machine might show traces of bunt when examined by this delicate test. In order to show to what extent this is the case the following test was made:—A sample of Cumberland wheat, supplied by Mr. Peacock, threshed in the ordinary manner, was centrifugalised in the way just detailed. The test was in all ways parallel to that just described, the sole difference being that the sample had not been artificially infected with bunt. The result should, therefore, show to what extent the machinery and other factors entered into the removal of 257 spores from each grain of the artificially-infected sample.

The resulting counts gave less than one spore to each grain of the sample tested.

It was thus shown that practically all the spores washed from the grains of the infected sample were due to the method of its preparation, and hence we may use the result as a basis in deciding on the degree of

infestation of any sample of wheat of the usual Australian Purple Straw or White Lammas type, that is to say, so far as a single test can furnish such evidence.

It goes without saying that further tests of this character will have to be made before an accurate factor will have been established. All that can be said at the present time is that the foregoing figures are probably a fair approximation to the ultimate results, and are of such a nature that they may be safely used as a practical guide in testing bunted wheat until better figures are available.

Let us assume that bunted plants have the normal number of heads and "grains." Then, as experiment shows 257 to be the number of spores likely to be washed from one grain prepared as described, *i.e.*, threshed from sheaves having one plant in every 700 bunted, it follows that a sample of wheat in which every thousandth plant was bunted would yield by this test about 180 spores per grain.

In my opinion it is desirable that further tests of this nature be made in order to establish a reliable figure or factor by the aid of which it will be easy to say, with reference to any sample tested, to what extent it was infested in the field. If it is possible to say, after a test so easy as this, that the sample came from a crop having so many plants per million, or so many plants per thousand, bunted, we shall have arrived at a stage in the history of this disease that may become a starting point for some small advance, providing, of course, this test becomes a recognised part of agricultural practice, as I am convinced it ought to do in wheat-growing regions where bunt is common.

The final step in this direction will be taken when it is known to what extent it is possible to disregard the presence of bunt spores on the seed-wheat.

It will be found, on reference to the article on the "Quantitative Estimation of Disease Spores," that a bunt ball, of the size of a 2·75-grade wheat grain, was found to contain about 8,000,000 spores. Bunt balls are seldom so large as this, the average being probably nearer half that linear size—*i.e.*, one-eighth that capacity. Taking 1,000,000 as the number of spores regularly present in a bunt ball, we arrive at the conclusion that if one in twenty of the balls became fully distributed on to the healthy grains in a sample derived from sheaves having one plant in a thousand bunted, there ought to be about fifty spores on each grain. Allowing the bunt balls to have one-half the volume of a 2·75-grade grain, we should arrive at 200 spores to each grain.

This latter figure corresponds with the estimate formerly made in the absence of any definite data. So it will be seen that the present examination tends, on the whole, to confirm the former estimate made as little more than a guess.

It would be desirable to examine a number of bunt balls to ascertain about the average number of spores to each bunt ball of average size.

No doubt steps will soon be taken to discover to what extent we may sow infected grain. The fact is, that hardly a sample of grain can be

found, *i.e.*, such as appears in the ordinary course of events, that is entirely free from bunt spores. Yet much of our seed-wheat produces clean crops in spite of this fact. From this it appears that there is a certain degree of infectedness that may be disregarded. Now, the centrifuge test is so delicate that it will enable us to make an economic use of this fact. It would be an eminently proper function of a seed-testing division of any Department of Agriculture to apply this test free of charge for the benefit of wheat growers. The test is one that can be easily and cheaply made if the number of samples to be tested is sufficiently large, rising, say, to hundreds. Certainly I can say, knowing what I do, that I would never think of dealing in seed-wheat without applying this test, nor would I, if a farmer, forego it if I had any considerable area of wheat to sow.

Conclusions.

1. Washing a sample of average Australian wheat that had been artificially infected, at the rate of one full-sized bunted head to about every 700 sound ones, and then threshed in the usual manner in a threshing machine, resulted, in the single test made, in washing from each grain an average of about 257 bunt spores.

2. Conversion of these figures to a decimal basis shows that a sample, in which one wheat-plant in a thousand was bunted, would yield by the same process an average of about 180 bunt spores per grain.

3. Until better figures are available, this factor may be used in determining the degree of infection of average samples of Australian seed-wheat.

4. The methods outlined will, on being further exploited, give reliable data for the testing of seed-wheat in respect to infection with bunt.

5. Further tests upon a variety of artificially-infected samples of typical Australian wheats are desirable.

6. Field tests of bunted seed, previously tested by the methods outlined, are desirable as a final step in completing the data necessary to fully examine a sample of seed-wheat by the centrifugal test.

7. The centrifugal test is one worthy of introduction in all wheat-growing regions where bunt is a common disease of the crop, with a view to aiding buyers of seed-wheat, and avoiding the cost of treating seed unnecessarily with fungicides.

8. An examination of bunt balls from various varieties and sources is necessary, in order to establish the number of spores per ball.

9. Further tests are necessary to determine whether two washings, as described, is the best number of washings for a practical test.

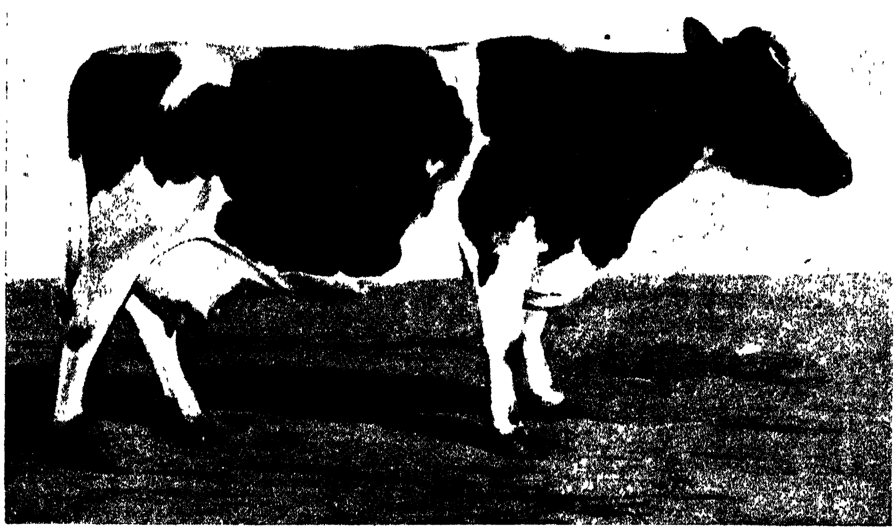
Dairy Cattle at Wollongbar Farm.

[Continued from page 843.]

C. H. GORMAN.

Records of Holsteins.

THE first illustration represents "Margaretha," an imported cow. She is exceptionally large, but possesses all the qualifications of a thorough



"Margaretha" (10439).
Photographed in 1905.

dairy beast. She was calved in 1892, and imported by the Department in 1898. Her records during the time she has been at this farm are as follows:—

1900.—In milk 244 days for 9,023 lb. milk, at average test of 3·5 per cent. butter-fat, representing 358·71 lb. commercial butter.

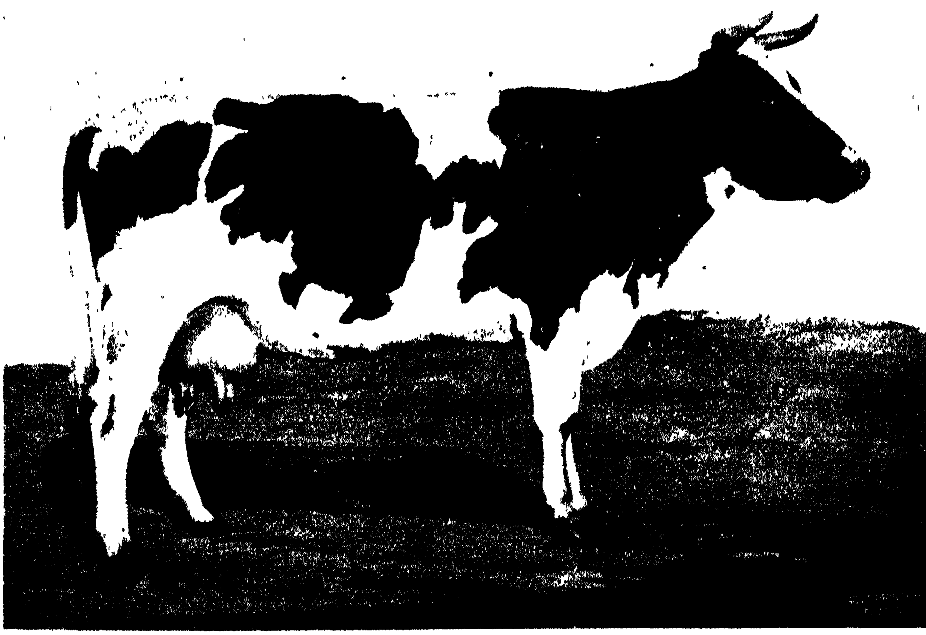
1901.—In milk 325 days for 10,904 lb. milk, at average test of 3·2 per cent. butter-fat, representing 407·83 lb. commercial butter.

1902-3.—In milk 219 days for 7,022 lb. milk, at average test of 3·2 per cent. butter-fat, representing 256·14 lb. commercial butter.

1903-4.—In milk 345 days for 9,939 lb. milk, at average test of 3·2 per cent. butter-fat, representing 381·53 lb. commercial butter.

The imported cow "Folkye 2nd" is shown in the next illustration. She is also a fine type of the breed and a good performer, as the following particulars show:—

1900.—In milk 306 days for 8,044 lb. milk, at average test of 3·4 per cent. butter-fat, representing 310·31 lb. commercial butter.



"Folkye 2nd" (9035).

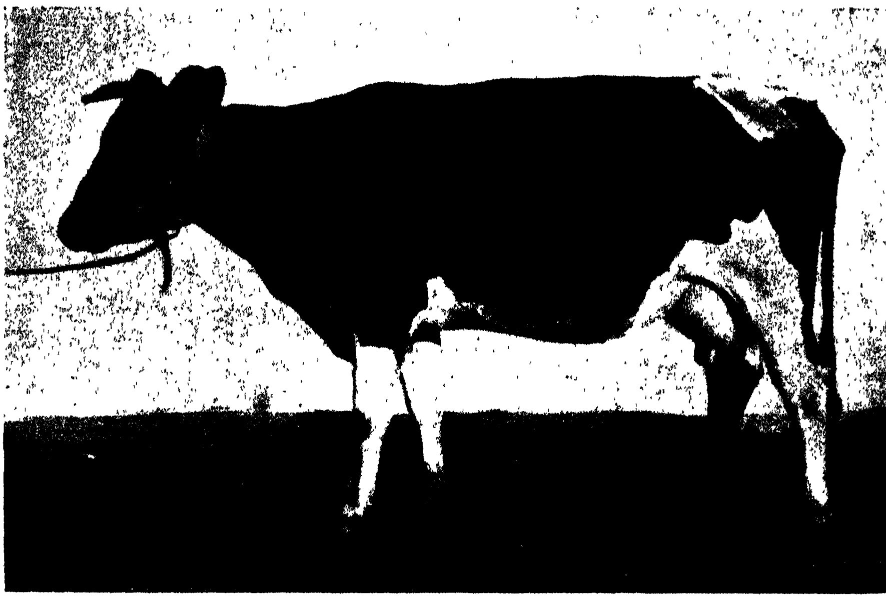
1901.—In milk 276 days for 6,464 lb. milk, at average test of 3·4 per cent. butter-fat, representing 253·60 lb. commercial butter.

1903.—In milk 263 days for 7,852 lb. milk, at average test of 3·4 per cent. butter-fat, representing 270·57 lb. commercial butter.

1903-4.—In milk 252 days for 7,675 lb. milk, at average test of 3·2 per cent. butter-fat, representing 303·11 lb. commercial butter.

The third illustration, of "Miss Douwe," represents a young Holstein bred at Berry Stud Farm. She was calved on the 14th May, 1899. Her records at this farm are as under:—

1900-1.—In milk 427 days for 6,664 lb. milk, at average test of 3·5 per cent. butter-fat, representing 272·1 lb. commercial butter.

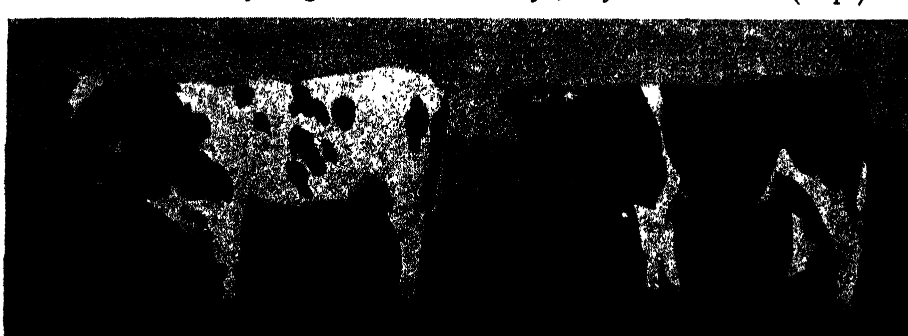


"Miss Douwe."

1903.—In milk 318 days for 6,314 lb. milk, at average test of 3·9 per cent. butter-fat, representing 272·78 lb. commercial butter.

1904.—In milk 351 days for 9,264 lb. milk, at average test of 3·9 per cent. butter-fat, representing 392·58 lb. commercial butter.

"Senator" is a young bull from "Folkye," by "Bosch III" (imp.).



"Senator." "Vice President."

"Vice-President," bull calf, from "Miss Douwe," by "President," who is by "Garfield" (imp.).

Dairy Notes.

M. A. O'CALLAGHAN.

Imported Holstein Cow, "Lolkje Veeman" (7850).

BRED by K. N. Kuperus, Friesland; born March, 1892. She took first prize as a calf, at Leeuwarden. She is now 13 years of age—the illustration

being from a recent photograph—she is still in milk, at the Berry Stud Farm and giving 4 gallons of milk a day. She was imported in 1898, when 6 years old; her best yield was 12,000 lb. of milk in 342 days, which is equal to 479 lb. of commercial butter. In the following year she gave 9,669 lb. milk in 306 days, testing on the average 3·5 per cent. butter-fat.

Dexter Cow, "Alcme Close" (Imp.).

THIS cow gave, at Berry Stud Farm, 2 lb. of butter per day for nearly three months after calving— her record one year was 715 gallons of milk, testing

on the average 4·3 per cent. of butter-fat, which is equal to 345 lb. of commercial butter; in 1903, when ten years old, she gave 627 gallons of milk, which tested on the average 4·42 per cent. of butter-fat, equal to 311 lb. of commercial butter.

Bovine Milk Fever.

H. M. WILLIAMS, Florida, Wollongbar.

EVERY man who has kept a herd of cows knows something more or less about milk-fever. He knows to his cost that it generally attacked his deepest milkers and the animals which were in prime condition, and he further knows that the great majority of animals attacked died from the effects. It may reasonably be asked, "Why was this, since vets. were called in, large and frequent doses of medicine given, and no expense spared?" The answer is simple. Until quite recently the disease was not properly understood, and hence the treatment was all wrong. For very many years this state of things obtained and every year the losses have been enormous, and losses will still continue until farmers are aware of the correct method of treatment. Now, I want every farmer to know that there is a safe, sure, and simple treatment by which he may cure practically every cow attacked with milk-fever, and he can do it himself. No necessity to call in an expert, no medicines required; and no trouble, and there need be no further cause for anxiety. We farmers have to thank our scientific men for the discovery, and truly grateful we ought to be. Now, this simple cure is the injection of common air into the udder. All you have to do is to fill the udder as tight as a drum with sterilised air by using the little apparatus provided for the purpose, and I give you my word that 97 per cent. of the cows so treated will be quite cured, up, and feeding in from three to seven hours. "Can this be true?" I hear you ask, and I reply "yes, it is an absolute fact upon which you can rely."

As soon as the scientists had completed their experiments, the Bureau of Animal Industry, U.S. Department of Agriculture, took the matter up, proved it to the hilt, and issued a circular to their dairymen, and this is what they say:—"Of all known methods of treating milk-fever, the injection of sterile atmospheric air into the udder is by far the most simple and practicable, as well as the most efficacious and harmless one at our disposal. For a considerable length of time the entire value of Schmidt's treatment was considered to be the antitoxic action of potassium iodide, and soon numerous investigators began injecting various other antiseptics with equally good results. Sterile water was tried with no increase in the mortality, and it was therefore considered that the distention of the udder was as important a factor as the antitoxic action of the iodide of potash.

Continuing along these lines, Kortman used antiseptic gases with beneficial results. Oxygen was then tried by Knüsel with increasing success, and the mortality in the experimental cases virtually ceased. The apparatus for treating with oxygen and etherised air, however, are expensive and cumbersome, and this greatly limits their use by the average practitioner.

To Professor Anderson belongs the credit of first having made use of plain atmospheric air. He first injected it with sterile water and then by itself. The results were astonishingly successful. Thus Schmidt reports that out of 914 cases treated, 884, or nearly 97 per cent., were restored to health.

Dr. John Mohler, V.D.M., Chief of the Pathological Division, wrote an essay on the treatment, and he says it is of the greatest importance that every milk producer should acquaint himself with the present extremely successful method of treating milk-fever by the injection of filtered atmospheric air into the udder, and advises every dairyman to become familiar with the method, and provide himself with a suitable apparatus for its application.

I have watched a good many cows die from milk-fever, some of them my own, too, and I quite despaired of the treatment then in vogue; but, fortunately, I got hold of the U.S.A. pamphlet, and it so convinced me that I determined to send for an apparatus and try it myself. The results have been marvellous. I only got the outfit in February, and my first case was on 2nd March, on the Lismore Showground, a blue ribbon milking Shorthorn cow, owned by Mr. D. Cooke, of Wollongbar. My very first effort was successful, and between that date and 1st August, I have treated and cured nineteen cows. Simple as ABC, and any boy of 15 can do it as well as I can myself. Our Richmond River farmers are all convinced now. One instance will suffice: On 17th June, Mr. David P. Shearer, of Singleton, on the Hunter River, received an apparatus, and in less than a month—*i.e.*, on 14th July—he wrote me that he had treated and cured five cows, and his neighbours were so impressed that they all wanted an apparatus.

I think, now, brother dairymen, you should all be convinced of this simple cure.

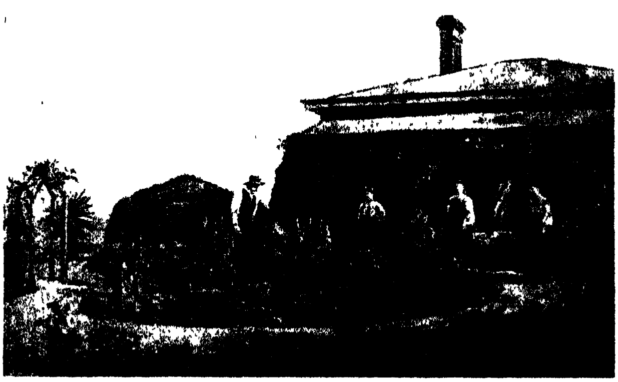
Our scientific men and our agricultural departments are hard at work trying experiments for the benefit of the men on the land, and it behoves the farmers to keep abreast of the times, by hard reading and adopting things which prove to be useful. It is no longer any use to do things for no better reason than because our grandfathers did them; we must ourselves know the reason for doing things, and until we do, we cannot say we are up-to-date. I do not say believe everything you read; but in reading, exercise your reason; read between the lines, and pick out all the good grains from the chaff.

In the *Agricultural Gazette* for September last will be found illustrations of a simple outfit, page 904.

Toothdale Public School

THE Toothdale Public School is situated in the lower South Coast District about 10 miles south of Bega, and a similar distance east of the port of Merimbula. The teacher in charge is Mr. J. A. Brown, and the beautiful grounds attached to the school are the result of his work, for when he took charge some years ago, the 2 acres in connection with the school were strewn with logs and trees; but these were soon cleared, and arbour-days arranged. The first lot of trees Mr. Brown supplied himself, but the Department provided the succeeding ones. Mr. Brown has since been raising trees and plants, and ornamenting his grounds with them. Two rows of pines, principally *Pinus insignis*, surround the playground. A bush-house has been built in the centre, and a tennis court formed. An extra 2 acres of land had to be procured to build the residence on, which is surrounded by a large and well kept flower-garden, with a bush-house at the side, the admiration of all who pass by.

Seed Sowing.



The Residence.

Mr. Brown has had the advantage of a good training in agricultural and horticultural matters. His father was one of the most up-to-date farmers, and a good botanist. It is, therefore, natural that Mr. Brown should take advantage of his position to impart, by means of practical demonstrations, his knowledge to the pupils who are fortunate enough to be attending his school. The school farm where Mr. Brown is quietly carrying on his great work consists of about 2 acres, most of which has been trenched by the pupils. On this farm Mr. Brown teaches his pupils how to prepare land for a crop, how to sow seed, and how to look after the crops while growing. Here also they receive practical lessons on

drainage, watering, mulching, manuring, raising seed, transplanting, rotation of crops, and fallowing. There is also a nice little orchard, the trees grown being raised in the school nursery. Lessons in propagating, budding, and grafting, and, later on, lessons on pruning in the orchard, are given. The effect of green manuring is also practically taught, and the effects experimentally demonstrated. The nitrification of soil by means of legumes has been well exemplified here, the crop grown for the experiment being cowpeas. Mr. Brown's ambition is to make his pupils practical farmers, and if they carry out the instructions and profit by his teaching there is no doubt they will.

A Pruning Lesson.

Mr. Brown does not confine his attention only to his school farm, but finds time to lend a helping hand in his district by giving instruction and help whenever asked. Mr. Brown is President of Candelo Agricultural Society, and on several occasions he has delivered lectures in his district in the interest of agricultural education, choosing such subjects as "Agriculture, and how to increase our Crops," &c. Lectures on "Fruit Culture" and Nature studies have been given to his pupils under such titles as: "How to watch seed germinate under glass"; "How leaves take in carbonic acid gas and cast out oxygen," &c. From this brief sketch some idea will be gained of the self-imposed task Mr. Brown has taken up, to have formed, by the aid of his pupils and at his own expense in many cases, the satisfactory school farm that is attached to the Candelo School, speaks volumes for Mr. Brown's enthusiasm. What is being done at Toothdale, Numba, Eglington, Leichhardt, and a few more schools might, with every advantage, be emulated throughout the State.

Planting Potatoes.

Every credit is due to Mr. Brown and other teachers, and it is only to be hoped that the time is not far distant when every school in New South Wales, where land is available, will have its school farm.

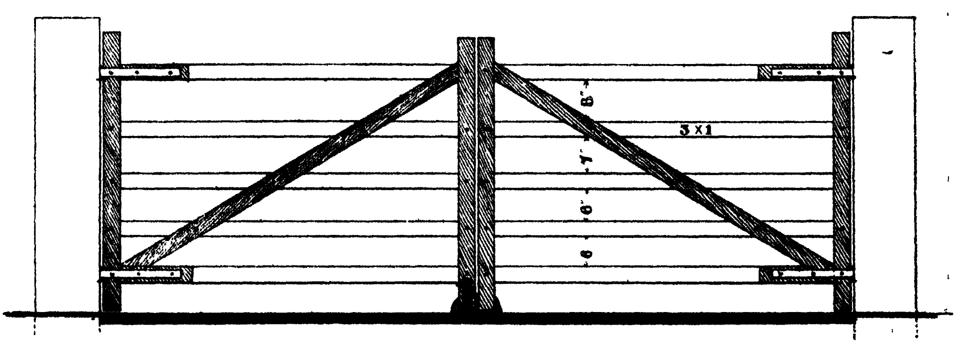
A Cheap Farm Gate.

R. H. GENNYS.

THE material required for, and the cost of a pair of gates, as shown in the accompanying illustration, are approximately as follows:—

	s.	d.
112 running feet = 28 super. feet of 3″ x 1″ batten @ 13s. per 100 feet super.	3	8
3 lb. $3\frac{1}{2}$″ x $\frac{3}{8}$″ bolts and washers, @ 4d.	1	0
2 pairs hook and eye hinges, @ 2s. 6d.	5	0
1 iron bolt and 1 gate fastener	0	7
Labour--making and hanging .	7	6
Total cost	17	9

These gates are made without any mortising, being entirely bolted together. The nuts can be given a turn if the timber shrinks and thus the gate kept rigid. A coat of paint, wood-preserving oil, or tar thinned



Farm Gate for a 12-foot opening.

with kerosene, will preserve the wood and improve the appearance. In the illustration the shaded parts represent double battens, while the unshaded parts are single battens, the double battens being placed on either side of the single rails and bolted through.

A sleeper should be let into the ground between the posts, and a stop-block let into this for the gates to close against. The posts should be let into the ground at least 4 feet deep.

Gates are better hung on posts in no way connected with the fence. If a strainer-post is used as a gate-post, the weight of the gate pulls the fence out of shape, while in cold weather the wires may draw the strainer back, and thus throw the gate out of plumb.

Onion Seed.

IN answer to an inquiry *re* onion seed, Mr. A. A. Dunnicliffe gives the following reply :—

The growth and sale of onion seed is not a matter which can be gone into as readily as growing wheat or maize. For the first few years a man's products may be worth something, or almost nothing—comparatively nothing until the grower has proved that his strain or strains are true to name and type, free from inoculation or disease, and are of strong vitality; and he works for three seasons before he has his first evidences. As he establishes his reputation on these points, his seeds will become valuable and saleable, and more esteemed as years go on. Some of our Sydney seedsmen have had their onion seed contracts with the same growers for the last quarter century, and would feel seriously disturbed if circumstances compelled them to change. Some local growers can only obtain 2s. 6d. and 3s. per lb.; others, who are growing into repute, get up to 10s. or more, which has been common for a long while. Twenty shillings is frequently paid for a good strain, and the writer has known £4 4s. per lb. to be paid during two seasons by onion-growers; but they could rely on every grain producing a fine bulb for sale. For a ready sale, the grower of seed must be well known to the buyer; and again, the market is not unlimited. With regard to the selection and curing of seed, I may say that an important matter should receive previous attention—that is, that the intending grower should start with the very best strain of seed obtainable. It will save both time and money. When the first crop is grown from this selected seed, the most perfect bulbs, true to type, and quite sound, should be selected, and afterwards replanted to produce the crop of seed. This process must be repeated every year to maintain and improve the standard. Care must here be taken to prevent the crossing of varieties, or very much of the value of these and previous efforts will be lost. If the weather will permit, the seed heads should be allowed to mature in the field, and afterwards finished in the shade. They should be free from rain or dew when taken in.

THE DEADLY EEL WORM.

IT is reported from the onion growing districts of Victoria that, owing to the ravages of eel-worm, the growing of onions is almost impossible. This disease was investigated by Dr. Cobb, late Pathologist to this Department, and the results were published in the *Gazette* in September, 1901, and reprinted as a pamphlet. This pamphlet — Miscellaneous Publication, No. 495—is available for distribution (gratis) to farmers, fruit-growers, gardeners, &c., on application to the Director of Agriculture, Sydney.

The Utilisation of Skimmed Milk in Feeding Pigs.

MR. HENRY H. WING, in a Bulletin issued by the Cornell University, describes at some length the experiments carried out with feeding pigs on skimmed milk, from which the following extracts have been made. The matter here is of no little importance, as the quantity of skimmed milk available from our growing dairying industry should be turned to the best possible use. On account of the great weight of skimmed milk in proportion to feed value, it becomes necessary to consider how the milk from the butter factory should be used—returned to suppliers for use on the farms, or fed to pigs at the factory, and thus save the cost of carting, suppliers being credited with the value of the skimmed milk.

"Each winter there is purchased for the use of the winter dairy-course at Cornell University a considerable quantity of milk. From this there results a large amount of skimmed milk, which is utilised in the feeding of pigs. Each winter some problem in connection with the utilisation of this skimmed milk for feeding is taken up in an experimental way. During the winter of 1903–4 particular attention was given to the determination of the money value of skimmed milk for pork production. This is a particularly timely topic, inasmuch as large amounts of skimmed milk are now used in many of the dairy districts of the State in the manufacture of casein and other products of similar nature. When skimmed milk is used for such purposes, the net return to the producer seldom rises above 10 cents (5d.) per hundredweight; and since writers frequently assign to skimmed milk a value considerably above this when fed to calves or pigs, it seemed worth while to make an actual demonstration to determine the value of skimmed milk for feeding purposes. One reason frequently advanced by farmers for the non-utilisation of skimmed milk for feeding purposes is that, in order to be most economically utilised, a considerable amount of high-priced food must be purchased, to be fed in connection with the milk. The experiments reported herewith were planned with the idea of using a maximum of milk and a minimum of expensive concentrated foods. In this, however, we were only partially successful, as the details of the experiment will show.

"The pigs, fifty-five in number, were farrowed in August and September, 1903, and ran with their dams until about 1st December. They were then weaned, and separated into six lots of seven to twelve pigs each, according to the size of the pens which were available. The pigs varied somewhat in age, and, consequently, in size, but were a fairly uniform lot. However, there was no selection practised, and the fifty-five pigs included every pig produced from nine brood sows. They were high grade Cheshires, with a slight dash of Chester White.

"The pens were only fairly comfortable, and the temperature went below the freezing point nearly every night during the course of the experiment. The pigs were crowded into rather close quarters, each pig having at the beginning as nearly as possible 14 square feet of floor surface. As the pigs grew the quarters became overcrowded, and on 15th February nineteen of the larger pigs were selected from the various pens and sold. The remaining thirty-six were fed until 12th March, when the experiment closed. The feeding was begun on 5th December, so that the total period was fourteen weeks, or ninety-eight days.

"The conditions under which the experiment was conducted were, therefore, no more favourable than would obtain on any ordinary farm. The pigs were an unselected lot, produced on the University farm; the quarters were not elaborate, nor even very comfortable; and the winter was the most severe that has prevailed in central New York for many years.

"The pigs were divided into six pens, numbered from one to six.

"Pen I contained seven pigs, and was fed skimmed milk and corn meal only.

"Pen II contained eight pigs, and was fed skimmed milk, with corn meal and gluten feed, mixed half-and-half by weight.

"Pen III contained ten pigs, and was fed the same as pen I.

"Pen IV contained nine pigs, and was fed skimmed milk, with corn meal and wheat middlings, mixed half-and-half by weight.

"Pen V contained twelve pigs, and was fed the same as pen II.

"Pen VI contained nine pigs, and was fed the same as pen IV.

"The summary of records of the gain in live weight for each lot, and the amount and kind of food consumed, is given in the following table:—

SUMMARY OF FOOD CONSUMED AND GAIN IN LIVE WEIGHT.

Pen and Grain Ration	Average gain per Pig per Day.	Food consumed for each pound of gain.		Pounds of Milk fed for each pound of Grain.
		Milk.	Grain.	
	lb.	lb.	lb.	lb.
Pen I.—Corn meal	1·01	9·6	2·8	3·4
,, III.— ,,	·96	8·8	2·4	3·6
Average	·99	9·2	2·6	3·5
Pen II.—Corn meal and gluten feed	·89	8·9	2·4	3·7
,, V.— ,, ,,	·97	9·5	2·	4·8
Average	·93	9·2	2·2	4·3
Pen IV.—Corn meal and wheat middlings	·89	9·8	2·3	4·3
,, VI.— ,, ,,	1·02	10·8	2·2	5·
Average	·96	10·3	2·3	4·7

"The pigs were fed twice a day, morning and evening. The grain was weighed out in convenient portions for each pen, and from this portion each pen was fed by measure from day to day until the portion was used up, when more was weighed out. The grain was put dry into the feeding-troughs, and the milk poured upon it. The milk was weighed for each pen at each feeding time, and the pigs in each pen were given all they would drink up clean.

"No attempt was made to secure uniformity of average weight in the separate pens. Pigs fairly uniform in size were put in the same pen, and in most cases they were largely of the same litter, since the pigs had not all run together, and pigs that were accustomed to one another were kept together so far as possible. Pen I contained the oldest and largest pigs, pen IV the youngest. The pigs in pen II were thought to be not quite so good in form and thriftiness as the others.

"Pen III, fed on corn meal and gluten feed, and pen IV, fed on corn meal and wheat middlings, made the smallest gain per pig per day (·89 of a pound), while pen VI, fed on the same ration as pen IV, made the largest gain (1·02); but the total difference is no more than might easily be ascribed to the difference in individual animals. The amount of food consumed for a pound of gain is also quite uniform. It was, if anything, slightly in favour of the pigs fed corn meal and gluten feed.

"All the pigs in pen I, one in pen II, four in pen III, four in pen V, and three in pen VI, were slaughtered on 15th February. The remainder were weighed on 12th March, and slaughtered on 15th March. The live weight at time of slaughtering, the dressed weight, and the percentage of dressed weight to live weight for each pen, are shown below. It will be noticed that there is very little variation in percentage of live to dressed weight in the various lots:—

RELATION OF LIVE TO DRESSED WEIGHT.

	Live Weight.	Dressed Weight.	Per cent.
Pen I	935 lb.	725 lb.	77·5
,, II	925 ,,	710 ,,	76·8
,, III	1,263 ,,	993 ,,	78·6
,, IV	1,003 ,,	775 ,,	77·3
,, V	1,542 ,,	1,174 ,,	76·1
,, VI	1,215 ,,	944 ,,	77·7
Average	......	......	77·3

"Former experiments have shown that the best results are secured when not over three pounds of skimmed milk are fed with each pound of grain. As is stated above, we intended to exceed this as much as possible, but, partly because of the excessively cold weather, it seemed desirable to feed grain more freely. Consequently, as the summary shows, we scarcely exceeded the 3-pound limit with pens I, II, and III, but pens IV, V, and VI consumed from 4·3 to 5 pounds of skimmed milk for each pound of grain, and made quite as satisfactory gains as the other three.

"Clinton has called attention to the fact in former experiments at this Station that the most economical results have been secured in different

years when the ratio of skimmed milk to grain varied from 2·5:1 to 6·8:1. It would seem as though there were need of further investigation along this line, and experiments are already planned for this purpose.

"As has already been said, the pigs varied somewhat in age and size at the beginning of the experiment. It is estimated that they were worth then an average of two dollars (8s. 4d.) apiece. With a little search, pigs of similar quality could probably have been purchased for somewhat less than that price. Because of the variation in size, it seemed more equitable to charge the value of the pigs at the beginning to each lot on the basis of the live weight at the time rather than at so much per head. The fifty-five pigs weighed at the beginning of the experiment 2,221 pounds. If they were worth \$2·00 apiece, or \$110·00 (£22 18s. 4d.), it would be almost exactly \$4·95 (£1 0s. 7½d.) per cwt. alive; and we have charged each lot on this basis. The corn meal cost us \$22·00 (£4 11s. 8d.) per ton, the gluten feed \$23·00 (£4 15s. 10d.) per ton, and the wheat middlings \$24·00 (£5) per ton. We have assumed the skimmed milk to be worth 15 cents (7½d.) per cwt. We sold the pigs dressed in Ithaca for \$6·50 (£1 7s. 1d.) per cwt The price of the feed and pigs is comparatively high. The price at which the pork was sold is lower than has prevailed in former years. The method of calculation is, therefore, rather unfavourable than otherwise.

	Debit.	Credit.	Credit balance.
Pens I and III..............	\$ 98·69	\$111·68	\$12·99
,, II and V..............	102·87	122·46	19·59
,, IV and VI..............	96·38	111·74	15·36
Total			\$47·94 = £10, nearly.

"After charging the grain feed at actual cost, and assuming a value of 15 cents (or 7½d.) per cwt. for the skimmed milk, there is \$47·94, or 87 cents (3s. 7½d.) per pig, and the value of the manure to offset the cost of labour and interest on the investment. It would seem, therefore, that skimmed milk can be utilised under ordinary farm conditions in producing pork, and return to the feeder at least 15 cents (7½d.) per cwt., or 50 per cent. more than can ordinarily be secured by the manufacture of dried casein and similar products.

"Summary.

"Skimmed milk was worth about 15 cents (7½d.) per cwt. (or 6½d. per 10 gallons) to feed pigs from weaning up to a weight of 125 pounds.

"Clear corn meal is perfectly satisfactory as a single grain, when fed in connection with skimmed milk.

"Weanling pigs in close quarters during cold weather can be made to gain a pound live weight per day for three months.

"There are indications that the proportion of skimmed milk can be increased economically above the ratio of three pounds of milk to one pound of grain usually recommended, thus lessening the amount of grain food that must be purchased."

Hawkesbury Agricultural College and Experimental Farm.

Notes from the Botanical Laboratory.

C. T. MUSSON.

Eel-worms in Potatoes.

THIS subject has been referred to in the past on several occasions when

Potatoes infested with Eel-worms.

dealing with potatoes, and in an early number of the *Gazette* the matter was dealt with at some length by Dr. Cobb.

Two years ago seed-potatoes were imported into this district badly infested with eel-worms, causing them to appear more or less lumpy, and deformed in growth. Planting these would introduce the pest to ground previously comparatively free from them, although some are to be found in most soils. Our last season's potato crop produced on one piece of ground many tubers badly infested with these minute worms. The accompanying illustration conveys a very good idea as to the appearance presented by the infested tubers.

It is worth noting that the ground on which the plants were grown has been for some years badly infested; but the pest had not been noticed as prominently present during the preceding year. Cowpeas and other plants were in the past killed-out in patches, for the worm when present in any considerable numbers will do a large amount of harm.

Growers should always be on the look-out for this potato pest. If the home crop shows it, all infested tubers should be separated and boiled for the pigs; such tubers should not under any circumstances be disposed of in any other way. Seed-potatoes, especially, should be carefully looked through, and any showing suspicious appearances should not be planted. If the lumps be broken by tearing the top off, using the thumb-nail or a knife (do not *cut*, but *break* the surface away), the eel-worms, if present, can be easily recognised as small roundish, glassy-looking objects, about the size of a pin-head, and somewhat milky in appearance. The naked eye will often detect them, but a small pocket magnifying glass is very suitable for the purpose. They are living in healthy flesh, which has developed slight enlargements of parts, and in this condition they are females charged with eggs, waiting until such time as the young worms hatch out before making their way into the soil, where they must pass the early portion of their lives, later to enter other plants in order to mature and reproduce themselves.

When the eel-worms are in the worm-form in plants the tissues are found to be more or less decayed in the immediate neighbourhood of where they are living.

Every effort should be made to keep this pest down. It works in the dark, and it is only on finding plants dying off, or the harvested potatoes lumpy, that the fact of its presence is brought home to us.

Prevent the pest from being brought in is the first thing to receive attention. If found to be in the ground, take steps to minimise the trouble by fallowing, rotation of crops, destroying the worms in infested plants, even by planting trap-crops in order to be able to draw them out of the soil.

"Pin-hole" in Potatoes.

Potatoes are frequently found with varying numbers of small holes or depressions in the skin, about the size of a pin-head. They extend from about one thirty-second of an inch to one-sixteenth in depth; the skin is

not broken, but the corky deposit extends some distance into the flesh. The holes may be numerous or few, and are usually arranged without any order.

No parasite has been detected. They are, apparently, caused by mechanical irritation of the skin. As the potatoes grew, the skin came in contact with straw-ends or other substances in the soil, strong and hard enough to press into the somewhat soft skin, but not sufficiently hard to penetrate it completely. Stable manure, particularly, if not thoroughly rotted, is likely to act in this way. The holes are not, however, of any great importance, unless heavy rain saturated the soil; when, as is also the case with scabby potatoes lying in the soil under similar circumstances, the holes (or scales in scabby tubers) would form points of attack whence rot might set up and damage the tuber. It is well to prevent such possible mechanical irritation by seeing that nothing is put in the soil likely to operate in this way.

Monthly Weather Report.

HAWKESBURY AGRICULTURAL COLLEGE.

Summary for September, 1905.

Air Pressure (Barometer).			Shade Temperature.				Air Moisture Saturation.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 13 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for 8 years.	% of the year's Evaporation.
29·50 14th.	30·23 29th.	29·99	25 5 1st.	79·6 4th.	53·16	57·37	40 15th.	86 21st.	56·8	0·241 14th.	in. 3·929	in. 3·378	7½

Rainfall ..	Dates...	18	19	21	22	Total for Month.	Mean rainfall for 13 years.
	Points..	111	5	16½	2	134½	197

	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
Wind	—	14	—	4	2	9	1	5

Thunderstorms on dates—21, 22.

Greatest daily range of Temperature, 46·1 on 2nd.
Extremes of Rainfall in September, 0·528 in 1897; 4·485 in 1895.
Frosts occurred on dates.—1, 2, 17, 26, 28.
Remarks.—The coldest September since we took records (1892). Spring delayed ten to fourteen days. Very dry before the rain of 18th, and heavy drying westerly winds afterwards.

CHAS. T. MUSSON,
Observer.

Orchard Notes.

W. J. ALLEN.

NOVEMBER.

THE most important work for all orchardists at this time of the year is cultivation, as, in most places, if this important work is neglected at this particular season, there is very little hope of their harvesting crops of fruit which will reflect much credit on the growers when placed in the market, nor will the proceeds from same very materially swell the bank account.

From time to time, the wail goes up that fruit-growing does not pay, that it is overdone, that the market is glutted, and, in consequence, the fruit has to be taken to the tip. If one has sufficient curiosity to take a run down to the markets in order to probe deeper into this matter, he will see so much inferior fruit being offered for sale, for anything it will bring, that he is struck dumb with wonder as to how the producer of fruit of such inferior quality can make a living out of it, and that, if they cannot produce anything better, the wonder is that they had not given up fruit-growing long before.

Again, side by side with this inferior fruit can be seen such fruit as no one need be ashamed of, and which almost invariably commands the highest market rates. We then wonder how it is that while some are growing good fruit, others are growing rubbish; but, if we have time to take a run out to the different orchards, the reasons are quite obvious. It may be that such important matters as the pruning, spraying, manuring, or cultivation have been neglected, or it may be that growers have done their utmost to carry out all of these processes and then failed, without, to them any apparent reason; but they must ascertain whether they have done the work well, and at the proper season. Inquiry generally reveals that this is usually not so.

It would be well if every grower would devote more of his time in looking after these different duties, and particularly the cultivation, as this is the one work which cannot be neglected, and without which no grower can hope to succeed. I would, therefore, urge on all of our growers the necessity for keeping their land well-worked up to a good depth, and under no consideration leave the ploughing too late in the spring, as during most seasons we require all the moisture which we can possibly

conserve in order to keep the tree in a healthy and growing condition, so that, in its turn, it may be able to supply the fruit with the required nourishment to bring it to maturity. Therefore, work the land well in the early spring, and from that time see that it is kept loose by repeated cultivations—not ploughings—as the latter process during dry hot weather turns up the moist land to the weather, and in place of conserving the moisture allow it to escape. Hence, in summer months, never plough, but keep the land thoroughly stirred to a depth of 4 or 5 inches by running the cultivator over it at frequent intervals, thus keeping the surface worked up to a fine tilth.

Towards the latter part of this month, the earlier varieties of peaches, cherries, and apricots will find their way on to the markets. The grower should grade and pack these honestly, in the most attractive way, so as to attract the attention of the public, when exposed to view on the market, and thus command good prices.

Summer pruning may be started this month, and it is well to go over and regulate the growth of all young trees, thinning and shortening back where required—that is, where the tree is growing too thick—and pruning or pinching back, so as to keep the tree evenly balanced and symmetrical. This early summer pruning is more for young trees, to aid in directing the growth to that part of the tree where it is most required.

December and January are the months for summer pruning the older trees in order to force out fruit spurs and buds.

In districts where the fruit-fly has been troublesome in previous seasons, I would recommend growers to be particularly careful in picking up and destroying all fallen and fly-infested fruits, and boiling them, in order to ensure the destruction of all larvæ which may be contained therein. As this is the only sure way at present known of helping to keep down this pest, I would urge on growers the importance of doing their best to destroy it.

Where irrigation is practised, a thorough watering should be given all trees towards the end of the month. This should be the second watering of the season. Be most careful to keep the water confined to the furrows, as, wherever the land is flooded, it is liable to become hard. As soon as the furrows are dry enough to work, cultivate the orchard twice, and loosen the soil around any young trees with a fork-hoe.

Every care should be taken to destroy the Codling moth, which makes its appearance about the time the apple trees finish blooming, lays its eggs in the young fruit and leaves, and, after hatching, works its way into the apple, and within a few weeks emerges and lowers itself down to the ground by a silken thread, and immediately seeks shelter by crawling up the tree and getting into any crack or underneath any old loose bark, either on the tree, on props, or any loose rubbish which will provide a hiding place. The orchard should, therefore, be kept free of such rubbish, and all trees bandaged at a height of about 10 inches from the

ground. The grubs will harbour in the bandages, which should, therefore, be removed every ten days, and all grubs killed. Pick up and destroy all fallen fruit.

Pruning of citrus trees may be continued wherever not completed.

Pruning and manuring of passion vines may be carried out the early part of this month.

Wherever Thorny mandarins show signs of cropping too heavily, it will be well to prune them a little more severely, as well as removing some of the fruit from the tree, so that the latter will not overbear and exhaust itself this season. If allowed to overbear, the fruit will be small and almost worthless.

Budding of citrus trees may still be carried on.

All citrus trees attacked by Maori or fungus diseases should be sprayed with Bordeaux mixture. In applying a spray like Bordeaux mixture to citrus trees, it will be found advantageous to apply the mixture in a small quantity at a time, in two successive sprayings, rather than one heavy application, which may run off the smooth surface of the young fruit.

Never fumigate trees for several months after they have been sprayed, as if they are so treated all the leaves will fall off, many of the smaller twigs, and occasionally the top part of the tree, will be killed.

The Cleopatra Apple.

W. J. ALLEN.

In this State this variety is almost exclusively grown under this name, while in Tasmania it is grown and marketed as the New York Pippin, and to those who intend exporting this variety I would recommend doing so under the latter name.

This apple is a well known and excellent American variety which is very popular in Australia. In many places it is very subject to Bitter Pit, particularly when the tree is pruned so as to form a close compact head. It is therefore best when pruning to open the tree out well so as to form a spreading head in order to admit the sun to every part of the tree. By following this system of pruning, and giving two or three sprayings with Bordeaux mixture each year, we have at our Bathurst orchard succeeded in

growing heavy crops of these apples comparatively free from this disease, and, owing to the fact that it is a heavy and constant bearer, it has proved to us a very profitable apple to grow.

Cleopatra.

Tree upright, vigorous, heavy crop, good even size in cluster, oblong conic, sometimes oblate: skin thin, lemon-yellow, with occasional blush in the sun: flesh white, rich, sub-acid, juicy, good flavour; good dessert and culinary; ripens evenly, will not hang on tree. Fair keeper, poor dryer: fairly free from codlin moth. Blooms 10th October, ripe 5th March.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of November.

Vegetables.

THROUGHOUT a very large portion of New South Wales the rainfall has been sufficiently good for the raising of vegetables this spring, whilst in places along the sea-board, where, as a rule, the rainfall is ample for the growth of almost anything, the season has been exceptionally dry, and the use of water for watering, or irrigating, has been necessary to keep vegetables growing. Whether this dry weather is likely to continue during October, no one can prophesy; but unless a change comes about, very early in the month, the sowing and planting of vegetables must be limited. Every effort should be made to grow something or other, for the use of the household, and doubtless a way can be found to carry this out, if anyone chooses to make up his mind to do so. It only needs a little determination.

If those readers who grow vegetables will observe well and watch the growth of their plants carefully, they may notice, sometimes, that amongst the different kinds, one or two plants will grow ever so much better than others, even though they be growing in the same bed, without any apparent advantages over the others. Perhaps it may be a cabbage or two or a lettuce, or something else. Now this may, and does sometimes, occur in quite a dry season, when other plants are hardly progressing. The chances are that such vigorous plants happen to be, to some extent, drought-resisters, and that if they be allowed to seed and the seed be sown, their progeny or some of them will also be drought-resisters, even better ones than their parents. This is worth following up, for it is extremely interesting and also of great practical value. Anyone who takes a real interest in this sort of work is more than likely to extend his observations to plants on the farm as well as those in the garden, and it is not at all impossible that he will be amply rewarded.

We sadly need observers, observers and observers, and if those school teachers who are now taking a keen interest in school gardens and the teaching of plant-growing, and so on, will impress upon their pupils the value of, and necessity for, making correct observations, they will lay the foundation of

splendid work, the results and value of which to the State may be more than can be imagined.

There are but few soils that will not respond to a liberal dressing of farm-yard manure, and if really good vegetables are required, this manure should be used without stint. For vegetables, it should be well rotted, and kept for some little time in a place where it is not washed by rain, or else the most useful part of it may be lost; at the same time, it must not be allowed to become dry. This may give a little trouble, but it is worth while taking some care. When the manure has been well rotted it is very probable that the seeds of any weeds it may contain will become rotten also, and a deal of weeding may be saved. Sheep dung very often contains innumerable weed seeds—sorrel, and others—and for this reason that otherwise excellent manure is objectionable, except when thoroughly well rotted. Pig dung is objectionable for vegetables, for when used it is liable to impart an objectionable, rank, and offensive flavour to the plants. It is, however, a splendid manure for flowering plants; and anyone who desires to grow fine roses could not do better than use it for his rose plants.

Beans, French or Kidney, are invaluable for summer use, and any varieties may be sown, as extensively as is likely to be required. One row of a runner bean (say) 20 or 30 feet long, if well grown, should yield an immense number of beans during its bearing period. If, however, this may not be considered sufficient, further sowings may be made during the month. Too much of any one kind of vegetable is not advisable, and variety is to be preferred. An application of a little lime, powdered gypsum, or superphosphate of lime, or of wood ashes to the soil and dug in a little time before the farm-yard manure be applied will, or should, improve the beans considerably. If superphosphate is used it may be mixed with the farm-yard manure. The mixing of lime or of ashes with that manure would probably cause loss in the liberation of nitrogen. Plant the beans in the row from 4 to 6 inches apart, and cover with about 3 inches of fine soil.

Bean, Lima.—A useful and reliable vegetable, much esteemed by some persons. The seeds are used in the same way as broad beans. There are varieties of both dwarf Limas and runner Limas, the runners being perhaps the most satisfactory kinds for general purposes. The tall varieties require a good deal of space, and need to be planted about 4 feet apart; but only a few plants are likely to be required, for they will continue to produce beans for a considerable time, and probably one sowing will be sufficient. The best variety of the tall kinds is King of the Garden, and the best dwarf is Burpees dwarf.

Beet, Red.—A valuable vegetable for summer use, which everyone should grow. Seed may be sown largely, if necessary; but it would be preferable to sow a little at a time, say once a week, just to have a sufficiency of roots coming forward for use. The globe varieties are the best, but it would be as well to try some of the long-rooted kinds. Sow the seed thinly and, unless the soil is pretty moist, water well after sowing. Do not manure the soil directly for this vegetable, but use some ground from which cabbages or

cauliflowers have been taken. As you remove the cabbages, cauliflowers, &c., dig and pulverise the soil very well and sow a few beet seeds about 2 inches deep, and when the plants come up and have made two or three leaves thin out to about 9 inches or 1 foot apart. Any beets noticed running to seed should be pulled up.

Beet, Silver.—May be sown in a seed-bed and afterwards well-grown, seedlings planted out. A good deal of rich manure should be used for this kind of beet, for the object to attain is large tender succulent leaves. Not many plants are likely to be required by anyone, for leaves can be pulled from the same plants during the season if not too many are taken at a time from each plant. The silver beets should stand about 18 to 20 inches apart.

Broccoli.—A little seed may be sown, and a few well-grown plants set out in districts where the heat is not likely to be very severe during the summer. The soil should be heavily manured for this vegetable.

Cabbage.—This will also require abundance of manure, and a considerable amount of moisture during its growth. A little seed may be sown, to keep a supply of plants going to meet requirements. Plant out a few strong young cabbages and cultivate them well during their growth.

Carrot.—Sow a few drills about 12 to 18 inches apart, and keep down weeds as soon as the seedlings appear. Thin out well.

Cauliflower.—Obtain the best seed procurable, and sow a little in seed-bed. Water frequently if the weather is dry, and shade during the heat of the day. Cauliflowers are unlikely to succeed during summer in hot, dry districts.

Celery.—Sow a little seed for succession, and plant strong young plants already sufficiently matured. This plant needs abundance of manure and considerable supplies of water during its growth.

Celeriac or Turnip-rooted Celery.—Sow a little seed in a seed-bed, or in drills where the plants are to grow. This will not need blanching or earthing-up. Its turnip-like root when cooked is considered a delicious vegetable by some persons. The plants should stand about 1½ feet apart. Keep them growing by the application of water should the weather be dry. Use also liquid manure liberally.

Cucumber.—Early plants should be bearing fruit abundantly, and ready for use by this time; but there are parts of the State where it is only lately that it was safe to sow the seed, owing to cold frosty weather. Keep the plants bushy by pinching the leading shoots. More seed may be sown if required.

Cress and Mustard.—Seed may be sown as required; but as the plants should be grown quickly, they may need a good deal of watering, and the application of liquid manure, during dry weather.

Egg-plant.—Seed may be sown where the season has been late, and seedlings raised in seed-bed may be planted.

Leek.—Sow a little seed from time to time during the month. Transplant seedlings to soil made as rich as possible with abundance of good manure.

Lettuce.—This is about the most welcome salad vegetable that could be grown for use in summer; but, unless the season is moist, it is rather difficult to grow well unless abundance of water is available. Transplant with great care any seedlings already raised in good rich soil, watering before removal thoroughly, and also after planting. Then keep them growing without a check. After this, sow in beds where the lettuces are to grow, and do not transplant, for they may not bolt to seed so readily as they might if transplanted.

Maize, Sweet.—Where this has been planted in the warm districts, the plants should be well advanced by this time. Keep cultivating them as long as they can be worked between. More seed may be sown if necessary.

Melons of various kinds should be doing well wherever the season has been good. Pinch leading shoots, and keep the plants as compact and bushy as possible.

Okra or Gumbo.—Plant seedlings, or sow seed when required.

Onion.—Cultivate well between the plants, and never allow any weeds to grow. A little seed may be sown during the month.

Peas.—Sow a little seed during the month, and keep up a supply as long as possible.

Peppers, Capsicum or Chili.—Seed may be sown or young plants set out in almost any district, if this vegetable is required.

Potatoes.—A few rows may be planted out in late districts. Keep down weeds, and cultivate well between the rows.

Pumpkins.—Sow seed of the Ironbark variety if they can be procured. As the plants grow, pinch the leading shoots.

Radish.—Sow a little seed, and grow the radishes as quickly as possible, so that they may be tender and mild. Use when small, and pull up any that have become large and pithy.

Rhubarb.—A little seed may be sown if plants are required.

Sweet Potatoes deserve to be grown more extensively than is the case at present. Cuttings which have been planted and have made good roots may be set out whenever there is no further danger of late frosts. The plants should stand about 18 inches apart, in rows about 4 feet apart. As the plants grow prevent the joints rooting, which they will do unless lifted now and then.

Spinach.—Sow a little seed.

Tomato.—Sow seed if plants are required. Plant out young tomato seedlings, and see that sufficient supports have been provided for growing plants.

Turnip.—Sow a little seed in drills. Thin out the seedlings, and cultivate well.

Vegetable Marrow and Squash.—Sow seed if any plants are required.

Flowers.

In some favoured parts of the State flower-gardens are all that could be desired, where a little trouble has been taken to plant annuals, perennials, roses, and so on. The stock, which is a favourite almost everywhere, has done remarkably well in some places but indifferently in others, being attacked by aphis severely. Where this pest attacks the stock, the plants had better be pulled up and something else planted in place of them; and nothing could be prettier than the salpiglot, the seed of which can be sown during the month, or the balsam, or zinnea, or sunflowers, which would very soon fill up the bare gaps. The best way is to raise the plants in a box or kerosene tin, or anything like that which may be available; and when the seedlings have grown an inch or so in height, plant them out. The handsome amaranths should not be forgotten, and if plants have not been obtained seed had better be sown as soon as possible. This is a good time to plant out dahlias, and those of the cactus kind are to be recommended. The single-flowering varieties are very pretty, and worth growing. When the tubers start into growth there will probably be several shoots, but only one should be allowed to grow; and as this grows it should be supported to a strong stake, to prevent its being broken down by winds; for the stem is brittle, and would very easily break if not protected.

TEOSINTE (*Euchlæna luxurians*).

P. QUIRK,

Berry Stud Farm.

THIS is a new fodder-plant to the South Coast. Teosinte was grown at Berry Stud Farm this year, and it promises to become a useful fodder for dairy cattle; but before any definite opinion is expressed with regard to its feeding value for milch cows, tests will be carried out and the results published. In the meantime these notes may be useful to those who are desirous of giving teosinte a trial. Seed was sown in October in drills 4 feet apart and 2 feet between the seeds. This allowed the use of the cultivator, so as to be kept free from weeds in the early stage of its growth; it requires cultivating at this stage, for if neglected it is impossible to cultivate later, as the plants form impenetrable masses. The crop had a very trying time, being sown early in October, there being only sufficient moisture to germinate the seeds and bring the plants above ground; the plants then received a check of two months' drought,

many of them dying out for want of moisture. When we received rain it made wonderful growth, throwing out about 90 or 100 stems from the one seed, and each clump attained the height of 10 feet. The produce of one seed, when cut, weighed fully 100 lb. The leaves grow to the length of 3 feet and form splendid forage. In its young state it is very saccharine, but when old it loses much of its saccharine quality; it throws out flower bunches all up the stalk. It is rather slower in growth than maize, but lasts much longer in a succulent state. This, in my opinion, is its great advantage, as maize requires to be cut at a certain stage, and if not, loses much of its feeding value, and teosinte will remain fresh and green for months.

In the State of Tennessee the general conditions for forage crops for winter use are remarkably like those experienced in the dairying districts of New South Wales. The results of experiments there cannot fail to be of interest and extremely instructive to our farmers. I notice in these experiments and series of investigations, undertaken with the special object of determining what crops can be most profitably cultivated for forage requirements in districts subject to long spells of drought, that teosinte yielded 26 tons per acre; rape, 18 tons; maize, 17 tons; cowpea, 14 tons; and sorghum, 11 tons. This experiment shows that out of twenty different crops and combination of crops the highest yield obtained was with teosinte. It produced a tremendous growth, and was highly relished by stock. The ensilage made from teosinte kept well, and was greedily eaten by the dairy cows.

Many of the visitors to the Government Stud Farm who have inspected the teosinte were much struck with its wonderful growth, and, I believe, will plant a trial sowing this year. One of its drawbacks is that it will not mature seed in our climate, it being a tropical plant, and requires a great amount of heat to become fully developed; it also requires good alluvial soil. Any land that will produce maize or sorghum should grow teosinte: 1 lb. of seed will sow over an acre of land.

Farm Notes.

Hawkesbury District—November.

H. W. POTTS.

This season in the Hawkesbury district may be remembered with others of the drought period, seeing difficulties of a like nature present themselves to the agriculturist and stock-owner. It is a pleasant reflection, however, to know that the arid area this season is circumscribed, and these notes only apply, fortunately, to a limited number.

The shortage in rainfall is pronounced, and while we had an inch last month, its usefulness was checked by a continuance of cold, bleak, westerly winds which practically negatived the benefits we might have secured. The spring growth of grass was checked, and frosts prevailed until the middle of October. The result was that stock had to be hand-fed all through the season. The grain crops are not a success, and have to be cut for hay. No sign of disease has appeared this year, seeing the moist conditions favourable to rust were not present. The crops are stunted, and flowering set in at half the normal height. In fact, in several places they were so thin and low that the mower had to be used, in others the crop has been eaten off.

Such a state of affairs places us in a similar position to what we confronted four years ago. We have to provide for next winter's conserved forage crop as well as green feed for summer and autumn: and every effort should be brought into force this month to get in suitable crops. All danger of frost is over, and we may with confidence sow maize, sorghum, millet, pumpkins, melons, sweet potatoes, cowpeas, soy beans, mangolds, and beets.

Lucerne Hay-making.—The first cut of the season was very light, and was utilised for stock as green feed. With the average summer showers the subsequent crops will be heavier, and will prove more suitable for hay. Considerable judgment is at all times demanded to make a good class hay. The aim is to cure it to retain a green, attractive, and relishable appearance, with the leaves attached to the stalks. The desirable food element is protein or albumenoids, *i.e.*, the nitrogenous compounds, which are leading factors in the growth of red or lean flesh, muscle, tendon, ligament, hair, wool, horn, the curd in milk, and other valuable food products.

It is this quality which makes lucerne so valuable for producing beef or milk, or as a portion of a horse ration; in fact, as a valuable nutritive substance it is useful for all domestic animals and poultry, and in every way rivals bran. The food constituents of bran and lucerne are, for all feeding purposes, equal. This explains, to a great extent, how the supply of lucerne practically controls the demand for bran in the open market.

The protein contents of lucerne leaves is about equal to that of bran; but the stalks of the lucerne plant only contain about one-fourth. It will be seen, then, that in hay-making our energies should be devoted to securing the highest percentage of protein which is in the leaves. Further, it has been demonstrated that the young plant, just as it is bursting into flower, contains a maximum of protein, and at that stage is most easily digested, relishable, and possesses its highest feeding value. With this knowledge we determine the best time to cut. For some time past it has been considered a rule to start cutting when one-fifth of the crop is in flower. Naturally, conditions of soil, climate, and situation, as well as drainage, have to be taken into consideration. The rule, however, of one-fifth in flower, can only be adopted approximately. Many growers start on the assumption that one-tenth in flower is the best time. Such can only be determined by the time it takes to cut the crop, number of machines employed, and other factors have to be taken into account. The principle to note is that the plant is at its best stage just as it is breaking into bloom when cut. Every day after that the leading element of nutrition is lessening. With dry weather, a moderately heavy crop, and well matured plants, few precautions are needed. The less handling it has the better. The strictest precautions should be observed to prevent the leaves falling from the stalks. If cut in the morning, the crop may be put into windrows, and stacked towards evening. Do not wait until the leaves are brittle and fall from the stems on the least movement. It is surprising what liberties can be taken with lucerne in dry weather, so as to get it into the stack green and pliant.

The ordinary rule is to cut close to the ground. This stimulates the growth of prolific crown below the soil surface, and ensures a steady increase in weight and vigour of succeeding cuttings.

Those engaged in curing lucerne for hay have to make a special study of local conditions to ensure complete success. It requires more thoughtful handling and skill than oaten or bush hay. Careless and rough handling entails loss at every point. Should the weather prove damp and the plants more succulent than is usual, it may be advisable to allow the cut crop to wilt for a day and rake into small cocks; if wet weather prevails, the American method of covering the cocks with cotton duck or unbleached calico caps to protect the hay from dew, rain, and excessive sunshine may be adopted. The cap is 4 feet square, hemmed on the edges, and to each corner a string is attached to fasten the cap to a peg in the ground. One prominent lucerne grower adopted the simple device of cutting horse-shoes in half and attached each half to the corner of the cap. When the cap was placed over the lucerne cock, the weight of the half horse-shoes at each corner caused it to sit close or hug the green hay and prevented it being blown off by wind. The expense of this method is light and has proved very successful. Our experience shows that often in wet weather the value of lucerne hay is reduced by one-half when exposed to rainy weather. Repeated wetting and drying from showers causes a loss in every case of digestible food constituents in the cured hay. Lucerne hay is so much more readily damaged by fermentation than ordinary hay.

Maize.—The first sowings of maize are now above ground and require this season more than usual attention, owing to the absence of stored moisture through the failure of our winter rainfall. We have to keep steadily in view the conservation of the abnormal quantity of moisture in the soil, and to this end we have to practise shallow cultivation. In addition to checking evaporation, it is essential to prevent the growth of weeds. Weeds not only absorb and utilise soil moisture, but also take up soluble plant food which is required for the maize plant. A suitable depth has been arrived at by a long series of tests. Any depth over 3 inches possesses the fault of disturbing or pruning the roots of the plant and retarding the yield to some extent. Cultivation not only causes the soil to retain its moisture, checks weed growth, but also keeps the soil cool. Frequent shallow cultivation, especially after showers or thunderstorms during the summer heat, will be found an important factor in obtaining a satisfactory crop either for green feed or grain. It is just possible, in fact it has been experienced, that the late frosts have damaged the first crop to such a degree as to entail the sowing of a fresh crop. We will require green crops for ensilage at the end of the summer.

Sorghums.—Last summer we had a trying time, owing to the excessive heat, bush fires, and general scarcity of natural fodders and grasses. The present outlook points to a similar period of shortage. The sorghum crops last year provided us with excellent returns and gave us further convincing proof of its great value, both for green feed, sorghum hay, and ensilage. Although somewhat tardy and delicate of growth in its early stages, the reward of attention amply repays the grower, and in this connection the success or otherwise of the crop depends on the cultivation and intelligent care devoted to the young plant. Both varieties, *i.e.*, the saccharine and non-saccharine, provide heavy crops in this district. Sorghum Saccharatum, Planters' Friend, and Early Amber are always available. On light soils where cultivation can be constantly carried out the results are highly satisfactory. Whilst the young plant is very susceptible to low temperatures, the matured plant will withstand early frosts. Sorghums have been fed green to cattle here up to the middle of July. In all hot and dry climates sorghums have been successfully grown, but the seed should be drilled in. The Imphee varieties will produce a crop on less moisture than is required for maize. The plants resist hot winds better, whilst the soil requirements are equal to maize. It has been frequently shown on our lighter soils on the Hawkesbury that where maize has failed under dry conditions sorghum has succeeded.

In the rotation we find sorghums succeed best after a crop of rape has been eaten off with sheep or pigs.

The surface of the seed-bed should be finer than for maize, seeing the seed is smaller. Seven pounds of seed to the acre when drilled is sufficient. A fertilizer of 1 cwt. to the acre may be used, consisting of equal parts superphosphate and bone-dust.

Any maize-planting machine may be used by inserting the special plate sent with it for that purpose.

The Kansas Experiment Station issued the following directions, which we have tested with good results :—

"Perhaps the best and most practical machine is the ordinary grain drill. As the rows should be 30 to 36 inches apart, the holes may be stopped by tacking a piece of pasteboard over all except those which will plant the rows the proper distance. On an eleven-hole drill, by stopping all but the outside holes and the middle one, the rows will be 30 inches apart ; or by arranging a thirteen-hole drill the same way the rows will be 36 inches apart, providing the distance between the shoes is 6 inches. A marker may be put on the drill by bolting a 2 x 4 timber to the middle post of the frame, and letting it project behind to fasten the marker to, and pull the other end by a rope or chain from the marker to the double-tree. Or a slab may be fastened to the frame of the drill and project out to the sides in front of the wheels, and a light chain or wire be fastened to the slab to drag in the wheel marks made the previous round, and so adjusted as to indicate the proper distance the last row planted."

Millets.—These hardy and useful forage plants may be sown this month, provided enough moisture is present in the soil to germinate the seed rapidly. Have the ground well cultivated and ready to sow immediately after a shower of rain. Amongst the varieties to sow may be mentioned White French, Japanese White, Pearl, Hungarian, Chinese White ; also Turkish, Manitoba, Broom, and Hog. They will flourish in a variety of soils, and best in a mellow soil rich in surface humus. Loams containing a medium admixture of clay and sand answer well. Where land is dirty and needs cleaning, a millet crop does this well. The arid conditions of a hot summer do not affect its sturdy and vigorous growth to its disadvantage. The surface soil is improved by light dressings of farm-yard manure, or a complete artificial fertilizer. As the crop is so vigorous, the seed may be sown broadcast, about 7 to 10 lb. to the acre, in some cases as high as 12 to 15 lb.

Pumpkins, Squashes, Marrows, and Melons.—Further crops of these useful dry weather plants may be sown in suitable locations. For pigs, sheep, and cattle, this class of succulent food is very useful in summer, and cheap. It will be necessary to cultivate freely to obtain vigorous growth.

Sweet Potatoes.—A further planting of sweet potatoes may be made this month. This useful tuber is essentially for hot and dry weather, and repays well all the attention that can be given to it.

Cowpeas and Soy Beans.—Of the hot weather leguminous forage crops, we may place cowpeas amongst the most profitable and suitable for rotation purposes. Not only will it give a rich, palatable green forage during the very hot weather, most refreshing and suitable for pigs and sheep, but they have the additional advantage of leaving the soil richer in nitrogen, and rendering it fertile for the autumn crops. The early maturing varieties, such as Black, White, Whip-poor-will, Warren's Extra Early, and Iron may be sown in full quantity. Soy beans provide a useful cleansing crop.

Mangolds and Sugar Beet.—Late crops should be more thickly sown than those already planted. The first crops are fit now for thinning out, and the rows well cultivated.

GLEN INNES DISTRICT—NOVEMBER.

R. H. GENNYS.

Maize.—The early maturing varieties only should be sown this month, as it is getting late, such as "Iowa Silvermine," "Pride of the North," "King Philip" (Ninety-day). For green fodder or ensilage any variety may be sown.

Pumpkins, Squashes, Beans, Cowpeas should be planted if not already sown.

Tomatoes may be planted out.

Sorghums and Millets may be sown for green feed and ensilage.

Potatoes should be sown toward the end of the month, or perhaps better still, in December. This important crop deserves much attention in suitable soils and climate. The lighter soils of New England are generally suitable and the climate favourable. Potatoes do well on a variety of soils, but light loams rich in organic matter produce generally the largest yields. Heavy clays should if possible be avoided, and all wet lands, as potatoes must have good drainage. If clay soils must be used, put in stable manure or something to keep the soil in as open condition as possible, otherwise the tubers will not be able to expand properly. New soils will often produce good crops of potatoes; but the land if possible should be ploughed twice and got into a good mechanical condition. It is on record that good crops have been obtained by simply turning the green sod on the sets, but the tubers are often a bad shape, probably long and flat.

Seed.—Great care should be exercised in procuring good sound seed, medium-sized the best; very small, the size of marbles, for instance, should be discarded; these, if boiled, are very excellent for pigs. Fair-sized, but rather small for market, are generally used; those planted whole, if otherwise sound, will keep best in the ground should dry weather supervene immediately after planting. If large potatoes are used cut into pieces, leaving two good eyes or more. Some authorities lay great stress on the size or weight of the sets more than on the number of eyes; about 2 oz. I think are a good weight. Seed potatoes should not have a spongy feel, but should be firm and sound. In cutting seed potatoes cut lengthwise. Do not keep the cut sets too long before planting. It is a good thing to put fine ashes on the divided tubers to heal the cuts before planting; the ashes with the seed are also good for manurial purposes.

Scabby Potatoes should be carefully discarded, also ground that has produced them should not be used for some seasons. A preventive for scab is 1 oz. of formalin to 2 gallons of water, soak the seed for two hours in the solution, afterwards cut into sets before planting.

Land should be deeply and finely worked for potatoes, and the sets should in no case be placed too near the surface—5 to 6 inches will be a good depth; but where hilling is intended during growth 4 inches will be sufficient.

Hilling, generally speaking, is not necessary; but in ground inclined to be rather wet it had better be done, the furrows between acting as drains. If on a slope, of course, the direction of rows should be up and down, not across the slope. Cultivation of some sort is necessary in all cases to keep down weeds and keep soil in good condition, and should generally be shallow, and during the time the tops are growing; afterwards better let alone or harm may be done. Care must be taken that tubers are not showing above the surface or they will be injured.

Potatoes may be simply ploughed in. Sow every third furrow, of say, 5 inches deep, allowing 1 foot to 15 inches between the sets. Harrow after planting, and it will do them good to harrow again when the plants are a few inches high. If a light harrow be used with teeth slanted backwards, this will disturb weeds and conserve moisture without hurting the young shoots.

Wood ashes and manures containing plenty of potash are the best for potatoes.

The varieties that have done the best here so far are "Cambridge Kidney" (an early sort), "Satisfaction," "Red Russet," and "Brownell's Beauty." The latter variety is a great favourite in New England, and deservedly so, as it does well here. A good potato for the table and also keeps well.

Riverina District—November.

G. M. McKEOWN.

Harvesting Wheat and Barley.

The use of the reaper and binder is recommended for the following reasons, viz.:—It is possible to place in a position of security a crop, or a considerable portion of it, while it is in a condition in which it is far less liable to damage than when it is left to ripen sufficiently to render possible other methods of harvesting.

1. A crop is in a condition for cutting about a fortnight earlier than for stripping, and the work of cutting may proceed under weather conditions unfavourable for the latter work, thereby admitting of much time being gained.
2. When a crop is allowed to ripen to the extent necessary to admit of stripping, one day's hot wind may cause the loss of the entire standing crop, while such conditions would be harmless to stacks, and comparatively so to wheat in stooks.
3. Much less grain is shed during the cutting of a crop which is seasonably dealt with than is the case when the stripper is used under its most favourable conditions, and the binder removes and includes in the sheaves the whole of the ears, while in an irregular crop many low heads are left untouched by the stripper.

4. The weight and colour of the grain which has been cut and stacked are superior to that harvested by other means, as in the latter case bleaching and loss of weight are to a greater or less extent inevitable.
5. Land upon which crops are cut will always be found freer from wild oats and other weeds, as such plants are to a great extent removed in the sheaves, and are dealt with in threshing.
6. The value of the straw is always worthy of consideration, as no matter how long it may be kept, our experience has shown that periods will recur when its value will be considerable.

This is practically admitted by many wheat-growers who, at present, use harvester or stripper for their grain, as they afterwards cut the straw with the reaper and binder. At this stage much of the straw cannot be harvested owing to it having been knocked down by the first teams and machines, while the value of the rest has been greatly depreciated by bleaching. In the long run it will be found that the extra cost of cutting, stacking, and threshing is far more than compensated for by the advantages gained.

A difficulty exists in many districts owing to the lack of contractors for threshing; but the demand would induce a supply, and the economy of cutting and threshing even a portion of the crop is strongly urged. In districts where the practice has been tested, there is no desire to depart from it. In our own district, since the drought of 1902, I know that there has been a demand for the threshing of grain at double the rates prevailing in districts where threshing has been the rule, and where, in consequence, more contractors' plants were available.

Time to cut.—Cutting should be commenced when the crop presents an even condition of ripeness, which will be evident in the rapid drying of the straw from the lower joints upwards, and in the condition of the grain, which should be well set and quite firm.

Stooking.—This work should be carried out with the greatest promptness, a sufficient gang of stookers being allotted to keep pace with each machine, so that at the close of the day's work no sheaves shall be left lying on the ground where they will be subject to injury by drawing moisture from the soil. Even should the soil be dry, delay in stooking may cause loss of grain, especially when the straw dries rapidly, through the great heat which at times prevails.

Stacking.—Carting to stacks should be placed in hand as soon as the sheaves are sufficiently dry to avoid risk of sweating; the bottoms of all vehicles being covered with large cloths to prevent loss of any grain which may shed in the handling. All stacks should have their bases secured against the risk of moisture rising from the soil by a good layer of straw or timber, and drainage should be provided to protect them from damage by surface water. The best size for stacks is about 27 x 15 feet, to contain about 50 tons. This size is the most economical in labour in construction, as well as in demolition for the purpose of threshing or chaff-cutting. The width should be gradually increased to 18 feet at the eaves, thus insuring proper drainage from the roof, as the water should fall clear of the sides

of the stack. The sheaves should be carefully placed in position, butts outwards, with a slight downward slope outwards, which is obtained by keeping the middle of the stack well filled and slightly raised, care being taken that all are properly bound. A skilful builder may accomplish the work with a fork without the necessity of kneeling to put the sheaves in position, the former method being much more expeditious. The access of rain should be prevented during the course of erection. The eaves should be about 12 feet from the ground, and to form them the last row of sheaves should project about 6 inches. To gain the necessary pitch to the roof three double rows of sheaves should be placed in the middle of the stack, lengthwise, but if the sheaves are not bulky more may be required. The necessary pitch may be maintained by placing each layer of sheaves (still butts outwards) further back than that next underlying it, so as to obtain a continuous slope to the ridge, the relative position of the middle being carefully continued, and the outer sheaves bound by the inner rows.

In the Wagga district, where the rainfall is not heavy, we are able by this method of building and topping stacks to dispense with the expense of thatching, as only the butts of the outer sheaves become damaged. These are cut off, and the upper portions of the sheaves are used as stock food when the material stacked is hay.

Barley.

Care should be exercised in order that the grain shall be thoroughly ripened, but that the straw shall not have reached a degree of dryness which will cause the ears, which are then in the condition known as "swan-necked,' to break off when being cut, as considerable loss would thus be caused.

The sheaves should be promptly stooked to prevent the grain becoming discoloured by contact with damp ground in event of showers falling. Stooks should be made of moderate size only (not exceeding twenty sheaves) to ensure free circulation of air, and rapid drying should need arise.

The best method of harvesting is by reaping and binding the crop, as the grain is improved by mellowing in the stack, and it can be better prepared for sale by threshing and grading in due course.

Stacking should be carried out with as little delay as possible after the crop is thoroughly dried so that it may be secured from adverse weather, as very little moisture at this time will spoil the colour of the grain and thereby considerably reduce its value to the maltster.

Great care should be exercised in threshing to see that the drum of the thresher is allowed sufficient space to prevent the grain from being cracked or closely clipped, as any damage to the skin affects its value by causing it to mould in the process of malting. It is preferable that the grain should be bagged with a small portion of the awn adhering rather than that it should be injured by close threshing.

As threshing machines are not everywhere available, there is in some parts no alternative but to use the harvester or stripper, in which case similar care will be necessary in setting the machines in order to obtain the best results.

Some of the winnowers and graders on the market will be found useful machines for the final preparation of the grain.

Where the quality of the grain is not up to malting standard, it will be found to be of good value as stock food, so that in any case a certain market will be found for it.

Clarence River District.—November.

T. WALDEN HANMER.

This part of the State is still suffering from an exceptional drought, and the weather is anything but encouraging from a farmer's point of view; and if the rain is withheld much longer, farming operations will be completely at a standstill. Many dairymen have already had to resort to hand-feeding their cows, which is a most unheard-of occurrence at this season of the year, and one that we trust will never be heard of again.

Despite the very dry conditions prevailing, we have had a beautiful crop of wheat at the Grafton Experimental Farm, all of which has been made into hay. The seed from which this was grown was supplied by the Department, and the varieties recommended by the Wheat Experimentalist, Mr. W. Farrar, were the milling wheat "John Brown" and the maccaroni wheat "Medeah." The latter variety yielded the best result. Owing to the drought no seed was saved. If the weather is favourable the following seeds may be sown.

Maize.—Any crops coming on should be given great care and attention, and suckers cut out, and the land between the rows kept thoroughly well cultivated as long as possible; the suckers could be carted out to the milking cows. If maize is required for green fodder, the "Ninety-day" will be found an excellent variety, and should be sown broadcast at the rate of about 1 bushel to the acre and about a quarter bushel if sown in drills.

Sugar-cane.—We are trying a little of this at the Experimental Farm—three varieties, "Iduria," "Mauritius Ribbon," and "Louzier." Cane-planting should be completed as early as possible, and the land between the ratoons should be ploughed as close as possible to the rows before a fresh growth is made. A little artificial manure will prove very beneficial.

Broom Millet may still be sown, and the best plan is to sow this in patches so that it does not all require to be attended to at the same time, as it takes a good deal of care and attention.

Mangel-wurzel or Mangold.—We think that our dairy-farmers would do well to try some of this root-crop, which is an excellent food for both cattle and pigs, and which will stand keeping well. The writer has had considerable practical experience of its value in the "Old Country" as a fodder for milch cows and pigs. Rich deeply-worked soil will produce the best results. Sow in drills 4 feet apart and thin the plants out to about 14 inches in the rows. Some growers adopt the plan of soaking the seed in warm water for

twenty-four hours before planting. This hastens germination. The varieties mostly favoured are the "Mammoth Long Red" and "Yellow Globe." The latter is the better for shallow soils.

Buckwheat may be sown this month. It is a very useful fodder plant, and when weather is favourable grows rapidly. It is a food much relished by fowls, and buckwheat-meal is an excellent meal for fattening fowls for market. Bee-keepers will find the flowers full of honey, and it is sometimes used as a green manure. In Canada, buckwheat cakes served with maple or golden syrup are reckoned amongst the housewife's breakfast dishes, so that it is easily seen it is an all-round article of diet. Any average land will grow this crop, if the land be well drained and thoroughly worked. Sow broadcast at the rate of about 1 bushel to the acre, or if sown in drills about half that quantity. Sow the seed and roll lightly.

Pumpkins and Melons may still be sown, and those plants already well advanced should be dusted with lime to keep off ladybirds and other insects.

Amber Cane and Planter's Friend may still be sown. Vegetables of the following varieties may be planted:—Lettuce, cabbage, cauliflower, French beans, peas, Swede turnip, and tomato. Seed-beds require to be shaded during the heat of the day at this season of the year, such shades to be removed in the evening.

It would be well to spray grape-vines with Bordeaux mixture, compounded according to Dr. Halsted's formula, as follows:—4 lb. of bluestone, 4 lb. lime, 50 gallons water. Some experts make the mixture a little stronger. If you want fine grapes take off some of the small bunches and stop the shoots by pinching off the tops.

Bathurst District.—November.

R. W. PEACOCK.

Rape.

The value of this fodder-plant for sheep, pigs, and cattle has been put forward so frequently that comment at present would be superfluous. For the Bathurst District there is no plant that can take its place for a winter fodder for the sheep carried on the farm. The same applies to pigs when carried on the paddock system. At this farm an area of rape is sown annually upon the basis of 1 acre for every ten sheep. During the past four years its growth has been attended with excellent results, and the growth has always been sufficient to carry even a greater number than allowed for on the above basis. Many farmers have applied for information respecting its cultivation, and have complained at not being able to grow the crop satisfactorily. In the majority of cases the fault rests with the farmer rather than upon the unsuitability of either soil or climate for its growth. Many farmers do not take the pains to cultivate their lands sufficiently, and can only succeed, and that only partially, with those crops which do not demand much skill or management and are easily cultivated. By methods

misdirected or faulty, they may get a crop or they may not, their stock may die or they may not, according to the severity of the season and the fickleness of Dame Nature.

The growth of such a crop as rape should be put on a safer plane, and the necessary care and pains taken to ensure success rather than allowing the element of chance to come too prominently into the undertaking.

The many failures in the attempts to grow rape lie in the fact that the soil has not been properly prepared for its reception. Land from which all the moisture has been pumped by a cereal crop and weeds is too often ploughed up a few inches deep when the time arrives to sow, and expected to grow a crop. To put it mildly, too much is expected from land in such condition. The season would have to be an abnormally moist one to give satisfactory results from such a system. The best time to sow is about the end of February, and usually at this season moisture is not abundant, but frequently lacking. The result is that, unless the land is well prepared beforehand, the seed will not germinate at the best time; the stand, when it does come up, is thin and weedy, and often too late to make a satisfactory growth before the cold weather sets in. If the land has been properly prepared, a few light showers will ensure germination, after which the plantlets can make use of the moisture stored in the soil. The crop should be fit to feed off early in May, and fully established to withstand the winter and provide an abundance of feed until the end of October, by which time it would run up to seed. The crop residue should be ploughed under before the seed is matured sufficiently to germinate, otherwise self-sown rape may prove a weed in the succeeding crop. If possible, a fair growth should be ploughed under, as the decaying vegetable matter becomes available as food for the next crop, and materially helps the physical condition of the soil. At this farm it has proved a most valuable forerunner of wheat.

To prepare the land for rape, advantage should be taken of the slack time of the present month (November) to plough the land intended for its growth thoroughly. It should be left in the rough and not worked down fine. All showers or storms are readily absorbed, and after heavy rains, a cultivation each time would create a soil-mulch and conserve the moisture. By the end of February it should be again ploughed and the seed sown broadcast at the rate of 7 lb. or 8 lb. per acre and covered lightly from ½ inch to 1 inch deep. The moisture conserved by summer cultivation and held by the soil, supplemented by light showers, will invariably ensure a good germination, which would have been impossible by slip-shod methods.

Generally speaking, January and February are comparatively dry months, and the evaporation excessive; it is, therefore, somewhat difficult to ensure the germination of small seeds, hence the necessity of the above precautions to ensure the desired end. Upon poor soils, the application of 1 cwt. per acre of commercial fertilizer, containing phosphoric acid and nitrogen, increases the yield considerably, and well repays the outlay.

The above practice applies to all small seeds for late summer and autumn sowings, such as lucerne, turnips, &c.

Crown Lands of New South Wales

THE following areas will be available for selection on and after the dates mentioned:—

FOR HOMESTEAD SELECTION.

H.S. or S.L. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
			acres.		acres.		£ s. d.	1905.
*986	Dubbo ..	......	1,541¾	4	301½ to 524	West Cobborah, 1¼; Dubbo or Mudgee, 46.	4 19 0 to 7 10 2	16 Nov.
*984	Moruya ...	(Also set apart as Special area, and O.C.P. only).	51½	7	5 a. 0 r. 25 p to 11¾ acres.	Port of Nooroomа, 2	0 2 7 to 0 8 10	30 ,,
*985	Narrandera	Binya ...	8,468	8	1,114 acres to 1,280 acres.	Whitton, 26 to 29 ..	10 9 0 to 12 0 0	9 ,,
*987	Urana. ...	Brookong ..	....	1	204½ acres.	Lockhart, 12; Milbrulong, 12.	4 9 6	21 Dec.

FOR SETTLEMENT LEASE.

H.S. or S.L. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
			acres.		acres.		£ s. d.	1905.
814	Coonamble	....	....	1	3,130	Gilgandra, 12...	32 12 2	9 Nov.
*818	Walcha	....	....	1	8,770	Walcha, 40; Walcha Road Railway Station, 52.	73 1 8	2 ,,
*816	Walgett....	Tory Wee Waa.	14,881	3	4,680 to 5,421	Walgett, 16 to 20 ..	78 0 0 to 101 13 0	23 ,,
*817	Warialda ..	Gunyer Warildi.	8,600	4	2,130 to 2,170	Warialda, 15 to 18; Warialda Railway Station, 18 to 21.	49 5 6 to 53 15 0	23 ,,

* Available for original holdings only.

For Conditional Purchase.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		a. r. p.			£ s. d.	1905.
*Bathurst ..	....	390 0 0	Oberon	Westmoreland	1 5 0	21 Dec.
,, ..	....	3,910 0 0	,, and Bolton	,, ..	1 0 0	21 ,,
*Carcoar ..	....	1,760 0 0	Gillindich	Georgiana ..	0 13 4	7 ,,
* ,, ..	....	3,200 0 0	Dunleary . ..	Bathurst ..	1 0 0	21 ,,
* ,, ...	....	590 and 640	,, ...	,, ..	1 10 0	21 ,,
*Casino	....	750 0 0	Pikapene	Drake ..	1 15 0	7 ,,
,, ...	Resumed Area 794 (partly).	2,300 0 0	Sandilands and Pikapene.	,, ..	1 0 0	7 ,,
Cootamundra ..	....	85 2 3	Congou and Jindalee.	Bland and Harden	0 12	7 ,,
Gosford .. .	....	40 0 0	Spencer . ..	Northumberland.	1 0 0	16 Nov.
,, ..	....	140 0 0	Wyong	,, ..	2 0 0	23 ,,
Goulburn .	....	220 0 0	Bolong	Georgiana ..	1 0 0	14 Dec.
*Grafton .	Resumed Area 907	216 2 0	Bagawa ..	Fitzroy ..	2 0 0	7 ,,
,, ..	....	400 0 0	,, ...	,, ..	1 0 0	7 ,,
,, ..	Resumed Area 653	143 3 0	Coombell . ..	Richmond ..	0 15 0	23 Nov.
Gundagai ..	Cotway . .	140 0 0	Gobarralong .	Buccleuch	1 0 0	21 Dec.
Gunnedah ..	....	560 0 0	Coogal . .	Pottinger .	1 0 0	23 Nov.
,, ..	....	1,330 0 0	,, ...	,, .	1 10 0	23 ,,
,, ..	....	308 2 0	,, .. .	,, ..	2 0 0	23 ,,
* ,, ..	Pillaway and Wallhallow.	256 3 0	Ferrier	Buckland .	2 0 0	30 ,,
Gunning ..	....	330 0 0	Romner	King	1 0 0	14 Dec.
*Kempsey .	Clybucca (partly)	521 0 0	Unkya and Allgomera.	Raleigh ..	0 15 0	9 Nov.
*Moruya	....	51 2 0	Wagonga .	Dampier	2 0 0 to 4 0 0	30 ,,
*Mudgee ..	....	700 0 0	Avisford .. .	Wellington	1 3 4	7 Dec.
Muswellbrook ..	.. .. .	170 0 0	Tomalpin ..	Hunter ..	1 0 0	7 ,,
,, ..	....	880 0 0	Rowan	Durham ..	0 10 0	16 Nov.
,, ..	.. . ...	64 0 0	Yarraman . ..	Brisbane ..	1 0 0	23 ,,
Picton .. .	....	7,700 0 0	Warragamba and Werriberri	Camden ..	1 0 0	30 ,,
*Rylstone ..	....	900 and 600	Capertee and Umbiella.	Roxburgh ..	1 0 0	30 ,,
Wagga Wagga.	....	859 0 0	Livingstone .	Wynyard ..	0 13 4	16 ,,
Wellington .	. ...	950 and 2,900	Canning .	Wellington .	0 13 4	16 ,,
						1906.
*Wyalong ..	Upper Wyalong ..	4,670 0 0	Drumston and Mildil.	Bourke and Gipps.	0 15 0	4 Jan.
						1905.
*Young (also set apart as Special Area.)		476 2 0	Wambanumba	Monteagle ..	2 5 0	7 Dec.

* Available for original applications only.

Special Area.

Moruya Land District, 51 acres 2 roods, in parish Wagonga, county Dampier: maximum area, 11 acres 3 roods; minimum area, 5 acres 0 roods 25 perches; price, £2 to £4 per acre. Available 30th November, 1905. (Original applications only). Identical with homestead selection area 984.

Young Land District, 476½ acres, in parish Wambanumba, county Monteagle; maximum area, 248¾ acres; minimum area, 40 acres; price, £2 5s. per acre. Available 7th December, 1905, for original conditional purchase only.

ROBERT McDONALD,
Acting Under Secretary.

AGRICULTURAL SOCIETIES' SHOWS.

1906.

Society.	Secretary.	Date.
Albion Park A., H., and I. Society	Henry Tryer ...	Jan. 17, 18
Gosford A. and H. Association	W. E. Kirkness ...	,, 26, 27
Kiama Agricultural Association	Jas. Somerville ..	,, 26, 27
Berry Agricultural Association	A. T. Colley ...	Jan. 31, Feb. 1, 2
Alstonville Agricultural Society	J. C. Foster ...	Feb. 7, 8
Central Cumberland A. and H. Association, Dural...	H. A. Best ...	,, 7, 8
Wollongong A., H., and I. Association (Wollongong)	J. A. Beatson ...	,, 8, 9, 10
Moruya A. and P. Society	John Jeffery ...	,, 7, 8
Guyra P., A., and H. Association	H. W. Vincent ...	,, 21, 22
Gunning P., A., and H. Society	Ernest E. Morgan	Mar. 1, 2
Bega A., P., and H. Society	John Underhill ...	,, 7, 8
Walcha P. and A. Association	S. Hargrave ...	,, 7, 8
Tenterfield Intercolonial P., A., and Mining Association	F. W. Hoskin ...	,, 6, 7, 8
Macleay A., H., and I. Association	E. Weeks ...	,, 7, 8, 9
Fair days	....	,, 9, 10
Berrima A., H., and I. Association (Moss Vale) ...	James Yeo ...	,, 8, 9, 10
Nepean District A., H, and I. Society, Penrith ...	E. K. Waldron ...	,, 8, 9
Bombala Exhibition Society	W. G. Tweedie ...	,, 13, 14
Clarence P. and A. Society, Grafton	T. T. Bawden ...	,, 14, 15
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Department of Mines and Agriculture,
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Agricultural Gazette of New South Wales.

Fruit-drying.

W. J. ALLEN.

THE subject of fruit-drying is a most important one to all orchardists, as hitherto the grower has been content to market his fruit in the fresh state, and has had to take what prices he could get, which were often very low, and in many instances scarcely paid the freight and marketing. In a State like this, with every advantage of climate, there is no necessity for the grower plodding along in the old lines laid down by his father and his grandfather before him, content with whatever he can get for his fruit, and satisfied that so long as it is a peach, or a pear, or an apple, or an apricot, as the case may

Picking Apricots at Wagga Orchard.

be, that one variety is as good as another. Let him ascertain which are the best varieties for their respective purposes. These are good for desert—well, plant as many as he thinks he can dispose of in that way; those are good for export—well, plant a certain number for that purpose, and for the rest of his trees plant such fruits as can be dried.

It is significant of the little attention which the subject of fruit-drying has received in this State that we are dependent almost entirely upon other colonies and countries for our dried fruits. This ought not to be where there are so many thousands of acres admirably adapted for raising fruits suitable

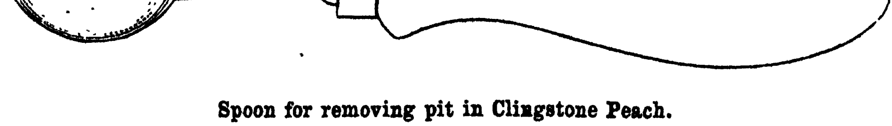
for drying, and also the climate necessary for producing the best dried fruits. In fact, in many of the interior districts the climate is so well adapted for fruit-drying, owing to the absence of fogs and moisture in the air, that the drying process could go on day and night. This lessens the chance of the moths depositing their eggs in the fruit, as it is not exposed for so long a time, and has also this advantage—that the fruit drying quickly, the trays can be emptied sooner than they could be in moister or cooler climates, and this enables the grower to handle a large crop with fewer trays, a great consideration to all orchardists.

Proper way to hold and cut fruit.

Where fruit is dried in an evaporator there is little risk of it becoming moth-infested, as it is not exposed as in the case of sun-dried fruit, and if the fruit is put into calico bags as soon as removed from the evaporator, there is practically no risk from this source.

It is greatly to be regretted that we in this State have not done more towards developing this important industry which, when it attains to the prominence it deserves, will not only be a source of considerable revenue, but will also furnish profitable employment for hundreds of people.

Dried fruits of all kinds are bringing very remunerative prices at present, the last few years being exceptionally good ones for those engaged in this industry. One of the largest brokers handling dried fruits in Sydney is reported, in an interview, to have given it as his opinion that, when federated



Spoon for removing pit in Clingstone Peach.

Australia is supplied, Mildura sultanas will hold their own against the world even in the London market, and that, compared with the Mildura sultana, the imported fruit is in every way inferior. This statement is further borne out by the quality of the sultanas which have been cured at the Wagga orchard in recent years, and which are pronounced to be exceptionally

good by all who have seen and tested them. Samples of these were on view at the Royal Agricultural Show, placed side by side with the best imported sultanas which the writer could purchase, and the difference in quality was so great that not even the most casual observer could fail to be struck by it.

It is to be regretted that, while Nature has been so generous to us in giving us all that can be desired in the way of soil and climate, up to the present time the fruit-growers of New South Wales have not had sufficient go in them to take up this most important but very neglected industry.

Proper position of placing fruit on the trays for drying purposes.

Great care must be taken in the selection of fruits, keeping in view the necessity for choosing such as produce the best drying varieties — that is, for colour and size, and such as will lose the least weight in drying; one of the objects—in fact, the main object—being to produce a dried fruit of good size and bright, clear colour, which, when graded and properly packed, will present the most attractive appearance.

The previous remarks apply mostly to sun-drying; but, in districts where this is not practicable, good results may be obtained by drying in the evaporator, and where this process is used it has, as above stated, the advantage that, with careful handling after the fruit has dried, there is very little risk of its becoming infested with moths.

Plant required for Fruit-drying.

1. Cases in which to handle the fresh fruit, such as peaches, apricots, prunes, apples, &c. Those which hold about a bushel of fruit are the most convenient to handle. They should be made strongly, so as to stand rough handling.
2. Where growers are operating in a large way, handling, say, from 5 to 25 tons of apricots or prunes daily, large sheets are required to place underneath the trees, so that fruit may be shaken off, in place of picking it; which latter, however, is best for small quantities.
3. Good sharp knives for use in cutting fruit, such as apricots and peaches, in halves. A knife somewhat similar to that used by shoemakers is about the best; but any knife with a short sharp blade will answer the purpose. Also, a pitting-spoon for removing the stones from clingstone peaches.
4. Dipping-basket for use in immersing the fruit which has to be dipped in the caustic-soda solution.
5. Dipping tank in which to mix and heat the caustic-soda solution which is used for dipping those fruits which require to have their skins slightly

cracked in order to hasten the drying process. Size of tank 2 ft. 6 in. x 3 ft. 6 in. x 21 in. deep. This tank can be made of either tinned or galvanised iron.

6. Trays for holding the fruit during the process of fumigating and drying.
7. A hand-barrow, for use in carrying the trays to and from the pitting-shed, fumigator, dipping tank, and drying ground.
8. A wooden fumigator, in which to hold the trays during the sulphuring process.
9. Evaporator, where sun-drying cannot be altogether depended on.
10. Drying ground.
11. Vat for holding brine in which to immerse apples after they are peeled and cored.

Apricot-drying.

As previously suggested, the planter should choose and grow only those kinds which make a good, bright, clear-coloured, large fruit, and one which does not dry away too much during the process. To begin with, the tree must receive, from the time of its planting, the necessary care and attention to enable it to produce a good crop of the very best fruit, both for quality and size. Small undersized fruits are more expensive to handle, they lose more in drying, are more difficult to dispose of, and they sell at about one-half the price of fine, bright, even fruit. This necessitates systematic and judicious pruning and thinning. If it is seen that a tree has set too much fruit, or more than it can possibly develop properly, pick off or thin evenly over the whole tree, leaving only such quantity as the tree will properly develop.

This thinning should be done during the latter part of October, and if the grower finds that there are still too many apricots left on the tree he may, if he thinks advisable, remove more just when the stone in the fruit is hardening, either the first or second week in November. It is not unusual for some of the fruit to drop at this period, in which case the second thinning may not be found necessary.

If irrigation is carried on, and the climate is very dry, do not be afraid to irrigate the trees at the time of ripening, if they appear to require it, as a little neglect at this particular time may make a great difference in the quantity and quality of the dried fruit. Experiments in California have shown that irrigated fruits do not dry away as much as non-irrigated—the former in a recent experiment taking $4\frac{3}{10}$ lb. of fresh to one pound dried, whilst the non-irrigated took $5\frac{8}{10}$ to one pound dried. Some varieties, of course, dry away more than others; the above experiments were made with the best drying varieties. In a cool, moist climate I would recommend the orchardist to pay particular attention to his cultivation, in order to keep the soil in proper tilth, in which condition it retains the greatest amount of moisture, which is a necessity for the well-being of the tree, and the consequent production of fruit. To make the best dried fruit, allow the apricots to hang on the tree until they are perfectly ripe, but not over-ripe, or so that they cannot be cut in halves with a sharp knife and still retain

their shape. In harvesting apricots for drying at Riverside, California, we had a gang of four men with a sheet placed underneath the tree ready to receive the fruit. The tree is then slightly jarred with forked poles, which are carried, one by each man, and when all the ripe fruit is shaken the sheets are taken up, and the fruit gently poured into cases holding about 35 lb. each. With a large staff such as we had there, of about 100 pitters and 30 pickers, we had apricots cut and in the fumigator two hours after they were shaken from the tree, so that any slight bruises were not noticeable on the dried fruit. When the fruit is fairly soft, pick it carefully into cases; this will, in all probability, necessitate going over the trees several times. As soon as possible have the cases carted to the cutting-shed, where the fruit should be carefully and evenly cut in halves (not pulled apart) and the pits removed. Place evenly on the trays with the cut side

Girls cutting and pitting Apricots for drying at Wagga Orchard.

up, and as soon as possible remove each tray to the fumigator, where it may remain, with the door closed, until the fumigator is sufficiently full to start the sulphur burning. This is of the utmost importance, as when once the fruit has been cut it must not be exposed to either sun or wind. When everything is ready, place sufficient sulphur or brimstone to fill the room with the fumes for about three hours (1 lb. to 300 cubic feet); but if possible allow the fruit to remain in the sulphur-room from eight to ten or twelve hours, or until the cup (that is the depression whence the pit was removed) is full of juice. It can then be taken out and immediately placed either in the sun or in the evaporator (as the case may be). If in the evaporator, do not place the fruit in the hottest part to begin with, but gradually work from the cooler to the hotter part (say) starting at that part which is 140 degrees, and finishing off at 180 or 212 degrees. In this way the fruit

will dry in from fourteen to eighteen hours; but the greatest care must be taken not to allow it to burn, and some practice will be required to tell when it is just dry enough.

If the fruit is to be dried in the sun use wooden trays, 2 ft. x 3 ft., which are made for the purpose, with a 2½-inch cleat at both ends. These are easily handled, and can be used in connection with all fruits. In cutting the fruit and placing it on the trays, place it on the top part or so that the cleats at the ends will be resting on the ground, thus allowing a current of air to pass underneath, which assists in the drying process. If the weather is hot, which it usually is about Christmas-time, it will take from two and a half to three and a half days to dry the fruit, which will require to be sorted over, so that any which is not quite dry may be put on other trays and allowed to stand for another half-day or so. The dried fruit should be taken from the trays and put into clean calico bags immediately and securely tied, so that the moths may not reach it. When sorting over in the above manner, any fruit which is small or of bad appearance should not be mixed up with the good, but removed and stored in separate bags, and marked as inferior; while the good can also be marked accordingly. When the fruit is dried and bagged it should be at once stored in a cool, dry place; if exposed to heat it will become hard, lose in weight, and deteriorate in quality.

Should, by any mischance, the moths have got into the fruit and deposited their eggs therein, an effectual means of cleaning or ridding such infested fruit is to dip it into boiling hot water for a few seconds, and then spread on trays and allow to dry by exposure to the sun's rays for a few hours.

Fruit thus dipped will not keep its colour long, consequently it should be disposed of as quickly as possible.

Peach-drying.

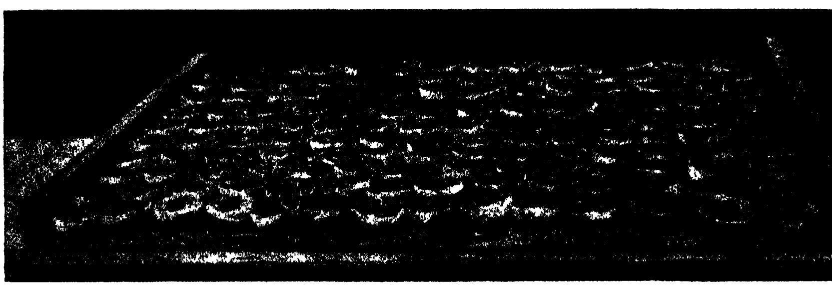
The process of drying peaches is very similar to that followed with apricots, but there are so many hundreds of poor varieties grown that it is very difficult to find peaches that make a first-class or commercial dried fruit. A freestone is really the only variety to grow for drying purposes, and one with a firm, yellow flesh, not too juicy, and above medium size. A peach of this description will make the very best commercial article, and one which, when properly dried and packed, would bring the highest price. A clingstone peach will dry, but will not sell so readily, and brings a much lower price. It is true it will not dry away so much, but with the market as it is, with keen competition from America, it will not pay the grower to place an inferior article on the market, for three reasons, viz.:—(1) Inferior fruits placed upon the market tend to lower the prices of good fruits; (2) they sell at such low prices that it barely pays the grower for his work in picking, curing, packing, and marketing; (3) they are usually the last fruits on the market to be sold, and very few wholesale dealers care to handle them, and, in consequence, will accept almost any offer to get rid of it.

I have in previous articles named certain good varieties which are especially worthy of notice. It may not be out of place to again refer to a few good

drying varieties, viz.:—Elberta, Lady Palmerston, Early Crawford, Late Crawford, Comet, or any other large-sized, yellow-fleshed freestone varieties, which ripen in January or February.

Although in California peeled peaches have always brought a much higher price than the unpeeled, they have not, in Australia, sold for sufficiently more to pay the grower for the extra trouble of peeling, and in consequence nearly all dried peaches found on the market are unpeeled. With some varieties it is found that the skin will slip off quite easily with a slight pressure of the thumb and finger immediately after the fruit has been fumigated, while other varieties require the use of a peach-peeling machine.

For drying, the peaches should be cut evenly in halves, placing them on the trays with the cut side up, in every way similar to the apricot, except that, at the most, they only require two hours fumigating; but if desired they may remain for a longer time in the sulphur-room, by opening the doors and allowing the air to circulate freely through the trays, after which they are



Tray of Peaches ready for fumigating.

placed in the evaporator or in the sun, as the case may be, and exposed to the same temperature as the apricot. They should be removed from the tray while quite pliable and not allowed to over-dry, then tied in calico bags and stored in a cool, dry place until ready to pack. If peaches are very uneven in size it is best to keep the different sizes together on the trays, as they dry more evenly than if the large and small fruits are mixed on the same tray.

Nectarines.

This fruit is handled in a similar manner to the peach, requiring the same treatment. I have seen them peeled, but as they dry away considerably the practice is to dry without peeling.

Prunes.

In our Departmental orchards we have found the Prune D'Agen and Robe de Sergeant the two best varieties for drying purposes. There are one or two other varieties which make a good commercial article in such districts as Batlow, and similar localities, but the above-mentioned are the varieties most largely planted, as they are in every respect suitable for the purpose. In the warmer climates the Robe de Sergeant carries a better crop than the

Prune D'Agen; they hang better during dry seasons and ripen earlier; therefore in climates similar to that at Wagga, this is the variety of all others to plant.

In the cooler districts, such as Bathurst, both kinds do well, while at the Kameruka orchard, near Bega, the manager tells me that the Prune D'Agen is superior to the Robe de Sergeant. It will, therefore, be seen that it is as well to make some inquiry in order to ascertain which variety is doing best before planting out an orchard.

Drying.

The fruit should not be picked until it is thoroughly ripe; then dip it in a solution consisting of 1 lb. of caustic soda to 8 gallons of water, when

Dipping Sultanas and Prunes at Wagga Orchard.

just on the point of boiling, and the fruit immersed from five to ten seconds, according to the toughness of the skin, or just long enough to slightly crack the skins. Should the lye-dip be made stronger, the prunes would not require such a long immersion. If the skins are cracked too much they will present a very rough appearance when dry and will be liable to go sugary. The fruit, which should be placed in wire or perforated metal baskets, should be dipped in the solution when it is just off the boil, then spread on trays to dry, and in the case of silver or light-coloured prunes, they should be put into the fumigator just long enough to set the colour well. After this the prunes are placed in the sun or evaporator (as the case may be). In the latter event the temperature should be about 130 degrees to start, and gradually increased to 180 or 200 degrees, this usually covering from one to two days, according

to the size of the fruit. If the temperature is too high when the fruit is placed in the evaporator the prunes will burst and stick to the trays and the juice will run away and stick to the trays and other prunes. The fruit when dried should be pliable; and when removed from the evaporator should be allowed to lie in sweat-boxes for a fortnight, so as to even up, then redipped in boiling water, to which a little salt has been added, for a period of three to five minutes, again dried, and finally graded and neatly packed in boxes, lined with white paper.

Drying Prunes at Wagga Orchard.

There is a machine which is used to prick the skins in place of dipping, which some people claim does equally good work, if not better; others use a combined dipper and pricker: our experience is that the dipping answers for all practical purposes.

The length of time required for drying the different varieties in the evaporator varies according to size. The smallest are sometimes dried in less than a day, while the largest take two days.

The fruit should be properly graded before being packed, and classed as follows:—20 to 30's, 30 to 40's, 40 to 50's, &c., up to 120 prunes to the pound.

Figs.

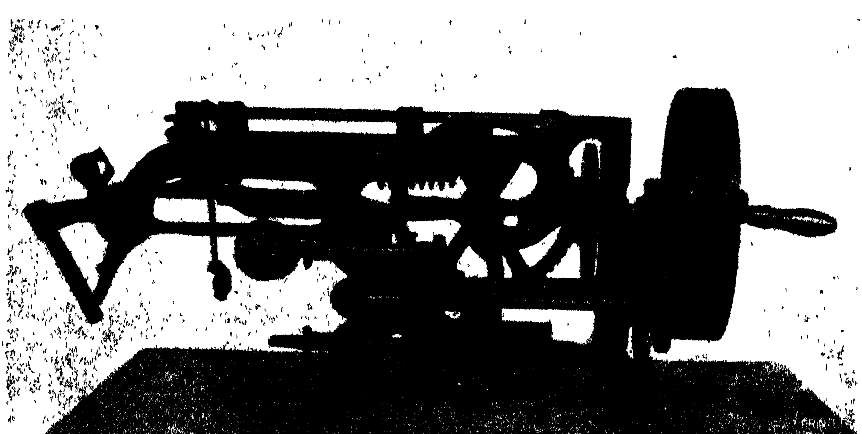
The fig is only fit for drying when it is dead ripe, as if dried when only partially ripe the fruit will be found worthless, and possessing none of the rich flavour which characterises the well-developed and ripe fruit. The varieties which have been found to bear fairly well, and make a very good dried fruit, are the White Adriatic and White Genoa, the former, I consider, being the better of the two.

The Smyrna fig, as grown in Smyrna, makes the best dried article; but as yet they have not been successfully grown here, as in no instance have I seen the fruit mature.

When the figs are picked (taking care to retain the stalks) they are dipped in a solution of 1 lb. caustic soda to 15 gallons of water, then placed on trays, with the bloom end down, sulphured for about ten minutes, and exposed to the sun for two or three days, when they should be turned. If picked when properly ripe, it should not take longer than five days of our ordinary summer weather to dry the fruit; but they must not be allowed to get at all hard, being taken up while quite pliable. After the figs are dried it is well to place them in a tight box, with a weight on the top to press them firmly together. By this means they will even up, all being brought to a uniform degree of dryness. In a week's time they are ready for packing; but before packing the fruit should be dipped into a weak brine, just on the boil, which not only assists crystallisation, but also adds to its appearance. In packing, the figs should be well worked out between the thumb and finger, and packed in boxes or drums holding from 1 lb. to 28 lb. I have improved the appearance of figs by the use of a little sulphur, but as I have seen so many dried figs practically ruined by over-sulphuring, I would not recommend its general use; but if practised, the following rule for sulphuring should be adhered to, viz.:—The figs to be exposed to the sulphur fumes just long enough to set the colour; figs which are not quite ripe requiring a longer exposure than fully ripe ones. From twenty minutes to half an hour at the most should be quite long enough for any.

Apples.

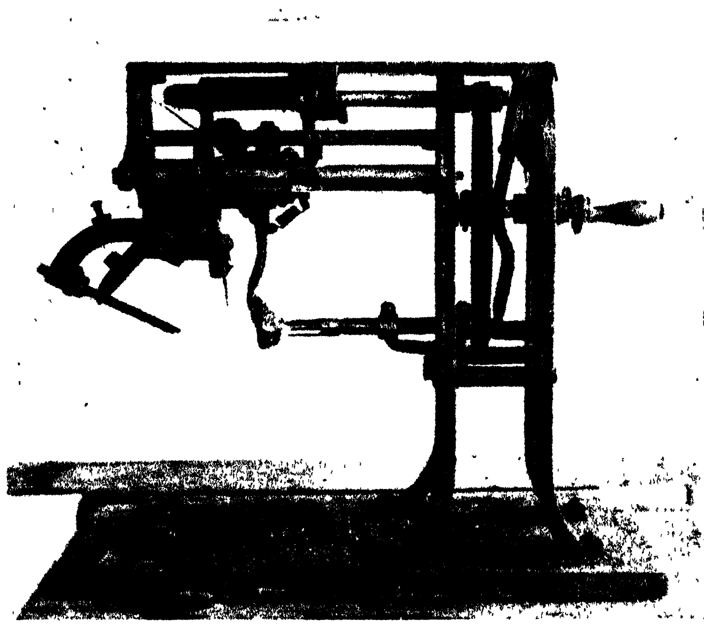
With the exception of some of the very juicy apples, nearly all of these will make a marketable fruit, although the most suitable are the larger



"Improved Challenge" machine for peeling and coring Apples—run either by hand or power.

cooking varieties, with firm white flesh, such as Munroe's Favorite, Rome Beauty, Dumelow's Seedling, &c. It is necessary to have a good machine,

which will peel, core, and slice at the same time. The fruit is allowed to fall into a weak brine, composed of 2 oz. of salt to the gallon of water, where it should remain for from five to fifteen minutes, when it is placed on trays (wooden ones being largely used for this purpose), and subjected to sulphur fumes just long enough to set the fruit a nice light colour. Great care must be exercised in the sulphuring, as if the fruit is left too long it becomes strongly flavoured with the sulphur, and consequently of very little value; about twenty minntes being quite long enough, though where it is dipped in the brine half that time would be sufficient. Also, it must not be allowed to stand any length of time before being placed in the sulphur-room as it discolours rapidly. After being bleached, the fruit is placed in the evaporator, and allowed to remain there until perfectly dry—that is, from six to eight hours exposed to a temperature ranging from 140 to 160 degrees, or even higher towards the finish. Care should be taken not to allow the fruit to burn or bake, as it would in either case harden as soon as exposed to the air. When properly dried it should feel soft and pliable to the touch. It is then put into sweat-boxes, and allowed to stand for a few days so as to even up the whole. Care must now be taken to keep the dried fruit away from the moths, otherwise they will get in and deposit their eggs and the fruit will be spoiled. If the fruit is to be kept for some time before packing, it is always best to keep it in calico bags, securely tied.


"Dandy" peeling, coring, and slicing machine.

Pears.

This fruit must be perfectly ripe for drying; they are then immersed in the lye-solution, composed of 1 lb. caustic soda to 10 gallons of water, just on the boil, after which they are plunged into fresh water and the skins rubbed off. Cut the fruit in halves, remove the cores with a sharp knife or spoon, sulphur, and proceed as with apples.

Raisin Grapes.

It will be found that the best raisin grapes are grown on the lighter and richer soils, and I have never yet in Australia seen a first-class raisin made from grapes grown on a stiff soil.

To make a good table raisin, the grapes must be grown to perfection—that is, the grape when ripe should be large, thin-skinned, fleshy, and containing plenty of sugar, and the bunches must be well filled, the larger the cluster the better the appearance of the dried article will be.

Hand-barrow used for carrying trays to and from packing-house, &c.

For making either pudding or table raisins, be sure that the fruit is perfectly ripe before picking, as for the latter purpose an under-ripe grape when exposed to the sun, will turn red (in most cases), and will also take longer to dry than a ripe one, and when dried will be a sour and inferior raisin. My experience with regard to picking is that, in nine cases out of ten, the inexperienced fruit-grower imagines that as soon as his fruit is sweet enough to eat, the grapes are ready to pick for raisin-making, and, contrary to all advice, will start picking, only to find at the end of the first week that the grapes are not turning a good colour. He then decides to

stop picking (if, indeed, it is not too late, and the grapes all picked) for a fortnight, so as to allow his fruit to become thoroughly ripe.

The only grapes which have so far produced a good commercial raisin in Australia are the Gordo Blanco and the Muscat of Alexandria. I have had samples of raisins sent to me made from other kinds of grapes, which did not present a bad appearance; but if the grower placed these on the market to compete with the raisins made from the Gordo and Muscat, he would find that they would not sell, so long as the latter were obtainable.

The process of curing the table raisin is as follows:—Pick the very best clusters—that is, only such as are well filled with large, fine grapes—cut out all damaged or hard grapes, and lay the bunches carefully on the trays, which are then placed in the sun. By the end of one week one side should be fairly well dried, and the bunches should now be turned. This turning is accomplished by placing an empty tray on the top of the full one. Two men can then take hold of the sides and invert the two, thus exposing to the sun the side of the fruit which had been lying next to the tray. After this turning it usually requires another week to finish the drying process, if the weather is favourable—that is, dry, warm days and nights. It usually takes from two to three weeks, under favourable circumstances, to cure good layer raisins; but if the weather is damp or threatening, it is better to stack up the trays at night, covering the stacks up with empty trays. If a table raisin gets wet during the curing process, it darkens the stem and spoils the bloom, and thus lowers the grade and value of the fruit. I do not consider that it will ever pay to cure table raisins in the evaporator, as they require to be dried slowly; and when exposed to a temperature, while drying out of doors, of more than 96 degrees, they will burn, and thus spoil the sample. I do not consider they could stand more than 110 degrees in the evaporator, and I doubt if the green fruit could stand even this temperature without it having a damaging effect. Therefore, I would not recommend growing grapes for raisins in a climate where the evaporator would have to be resorted to.

Proper way to stack trays during wet or hot weather.

Pudding Raisins or Lexias.

Grapes intended for this purpose should also be plucked when fully ripe. All partially ripe and dried fruit should be removed, and the grapes then immersed for about three seconds in a lye made in the proportion of 1 lb. of caustic soda to 8 gallons of water; and this *must* be kept just under the boil, as the dip will lose its effect if the lye is only fairly hot, and the fruit, instead of turning out a nice golden colour, would be brown. This, however, is not always the cause of the raisins being brown in colour, as it is impossible to make a good, bright Lexia, or good quality of raisin of any sort, from grapes grown on some of the heavier or stiffer soils. After the dipping process, it usually takes from five to eight days for the fruit to dry, this depending on the weather. About the fourth day after dipping the grapes should be turned; but do not allow the fruit to become too dry before taking it in; a nice, pliable fruit being always the best. If there is any uncertainty as to whether the fruit is sufficiently dry or not, it can be tested by squeezing a few of the raisins between the thumb and finger, and if no moisture exudes, then the fruit is quite dry enough. The Lexias should be stemmed and graded as soon as possible after they are dry enough to remove from the tray to the sweat-box, as, if allowed to stand any length of time, the stem becomes toughened, and hard to separate from the raisin.

Curing Sultanas.

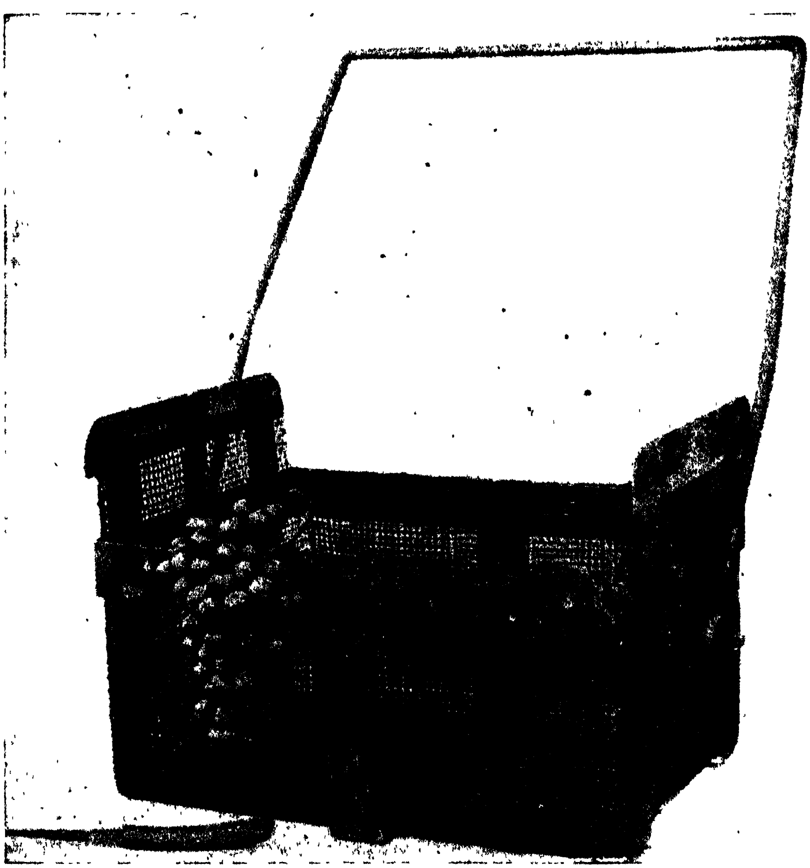
My advice to those growers of sultanas who have never yet dried any is to this effect: When you think the fruit is ripe enough to pick, leave it for at least another fortnight, as, when they are quite sweet and fit to eat, they are not by any means fit to dry. When they are a clear, amber colour, and perfectly sweet, without a trace of acidity in any of the berries, they should be about ready to pick. The last fortnight, before the fruit has attained this stage, adds considerable sugar, which means increased weight and a better quality of dried fruit; consequently, it is best to pick when it is dead ripe, and dip as soon after as possible in a lye made in the proportion of 1 lb. of caustic soda to 8 gallons of water, or a little stronger if the skins are very tough. The fruit must be dipped while the lye is just under the boil, but must not be immersed for longer than two seconds, after which the grapes are spread thinly on the ordinary drying trays, and exposed to the sun for a day or two. The fruit should always be turned the day after dipping, which latter process is described under Table Raisins. If the nights are cool, or rain threatens, the trays should be stacked up, and the stacks covered with empty trays, so that the fruit cannot be damaged. If the weather is very hot, the trays may be stacked up and allowed to remain thus until the sultanas are dry. Never expose sultanas to too great a heat, or the colour will not be good; and it is essential, if the grower desires to get the best prices for his fruit, to make a good, light-coloured article.

Zante Currant Curing.

The Zante currant is very easily cured. Allow the fruit to hang until thoroughly ripe—that is, until some of the currants begin to shrivel on the bunches—then pick and place on trays; but do not fill these too full, or the fruit will roll off. Expose to the sun for four or five days, when they should be dry enough to be put in bags. Should, however, the temperature exceed 96 degrees in the shade, stack the trays until the weather is cooler. Care must be taken with this fruit, as, if exposed too long, the moths will infest it; so that I strongly recommend bagging it until the fruit is stemmed and properly packed.

Dipping-basket or Tray.

This is made of strong galvanised wire, ¼-inch mesh, and bound with hoop-iron, and so constructed that it revolves within the handles, thus making it



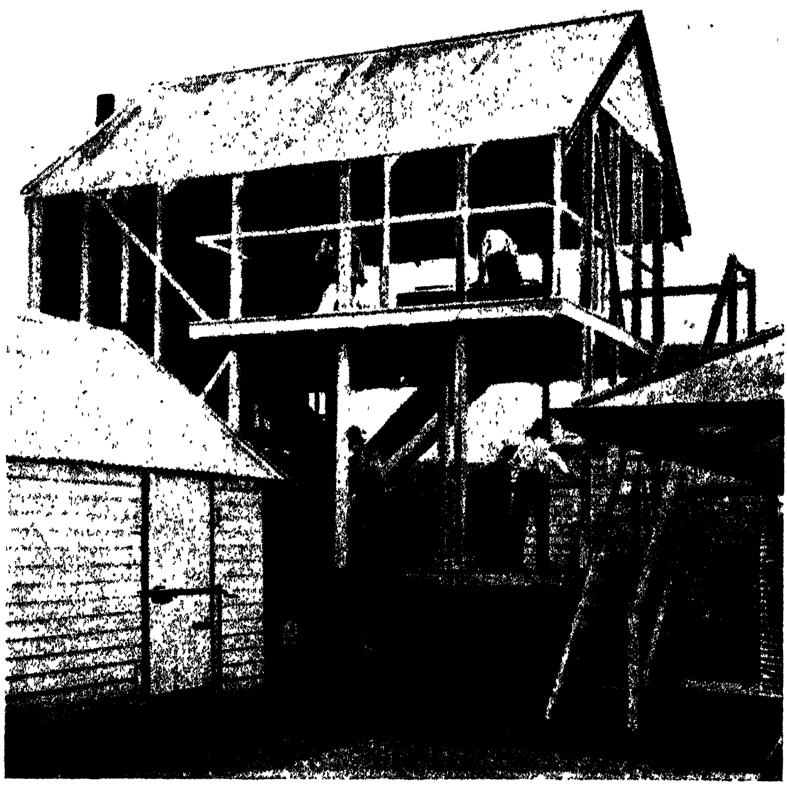
Dipping-basket for immersing fruit in lye solution.

quite easy to empty it of fruit after dipping. Such a dipping tray or basket is suitable for dipping prunes, sultanas, raisin-grapes, &c. It is about 3 inches longer and 2 inches wider than the ordinary kerosene tin.

Fumigating and Sulphuring.

The fumigator should be built handy to the cutting-sheds and drying-ground. It should be large enough for the requirements of the orchard, but I would not recommend building a room so small that it would not hold at least a hundred trays—that is, unless the grower has only a few trees, when almost any fairly air-tight box capable of holding a dozen trays would answer the purpose.

A good-sized room for an ordinary orchardist is one 9 feet by 10 feet and 6 ft. 6 in. high on the inside, built of tongued and grooved boards, and put together with white lead. Any small cracks can be filled up with putty, and if the room should be found to leak, it can be papered inside.



Fumigator on the left. Evaporator at Wagga Orchard.

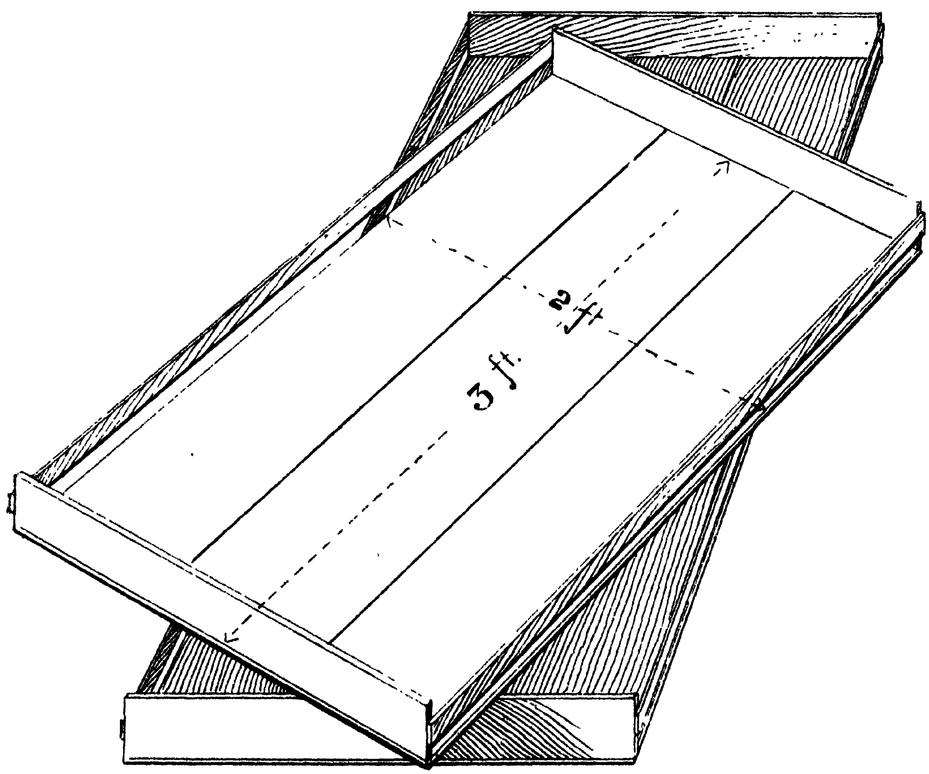
Fruit sulphured in a large room rarely ever tastes of the sulphur, and this is the great advantage of having a good-sized room, even though it takes a little more sulphur. A room such as this will hold 300 trays quite easily, and requires about 2 lb. of sulphur.

If the orchardist has only a small quantity of fruit to handle, this could be sulphured by taking a good-sized packing-case capable of holding a dozen trays; paper it inside, and having stacked the trays one on top of another,

place the box over the top of the whole. This should be placed partly over a hole in the ground, previously dug for the purpose, and from 2 ft. 6 in. deep, wherein the sulphur is to be burnt in a small iron pot. When the sulphur is lighted, cover the hole closely on the outside with a piece of iron or board, so that the fumes cannot escape.

Drying-trays.

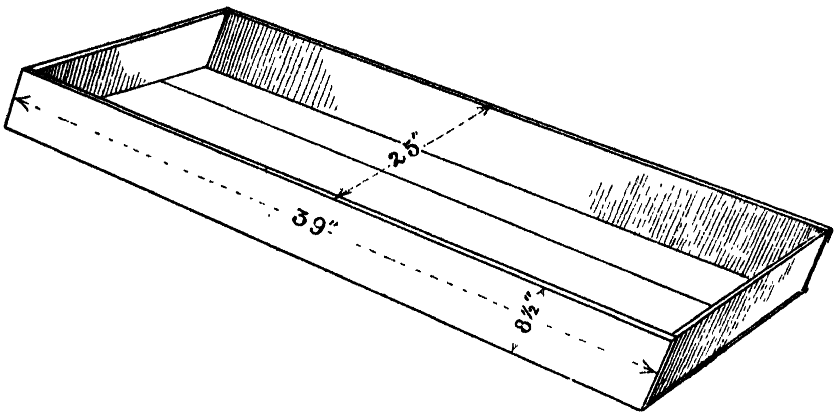
These are made with either three or four boards. I prefer the three boards, as there are not so many cracks, which is an advantage in curing small fruits such as sultanas, currants, &c., and they appear to hold together better than the four-board tray.



Drying-tray.

A good tray is made as follows:—The ends or cleats are made $2\frac{1}{2}$ inches wide, and $\frac{7}{8}$ inch thick; the three boards $\frac{1}{3}$ inch thick are then nailed securely on these cleats by driving four nails in each end—nails to be 2-inch round wire nails with flat heads; each tray to have a strip about $1\frac{1}{2}$ inch wide on sides, nailed to ends. Such a tray as this is useful for any fruit drying in the sun, and can also be used for storing lemons and oranges by placing in sweat-boxes with a layer of fruit on each.

In drying fruit, these trays, when necessary, can easily be stacked one on top of the other, and the stack covered with two empty trays to keep the rain off.



Sweat-box used for handling dried fruits.

These trays should not cost more than from 7d. to 8d. each by the thousand in Sydney.

Drying-ground.

A lucerne paddock makes an excellent drying-ground, but the fruit dries more slowly than it does on the dry ground; any clean unbroken ground may be used instead. This, of course, has its disadvantages, as the dust rises

Packing dried fruits at Wagga Orchard.

easily, and great care should be taken to keep the ground sprinkled where-ever it has to be walked over. By taking this precaution the fruit can be kept quite clean, and it dries more quickly than when the trays are spread on lucerne.

In spreading the trays do not leave roadways between them, but place them side by side, so that the whole ground is covered, and thus there are only the outside trays to watch. This applies to the stone fruits more particularly, In placing raisins out to dry it is necessary to arrange the trays so that the fruit can easily be turned, therefore in this case it is necessary to leave a narrow roadway between the rows.

Evaporator.

Up to the present this means of drying has not been largely used, but there are a few small home-made evaporators in use, which are turning out good samples of dried fruits and vegetables. In our warmer climates, these are seldom brought into requisition, but in our moist coastal and cooler districts they are very necessary.

The Magpie.

Mr. A. Lansdowne, Goulburn, writes:—"After reading the article in the *Gazette* last month (October) 'A List of the Insectivorous Birds of New South Wales,' I would like to give my experience *re* the above bird. I was born and reared in a garden, and my father always encouraged the Magpie, both the old common black and white, and also the grey, species. I continued my career under my brother, who was an expert in garden work, and he always did the same, as also did other growers with whom I was afterwards associated. I had a farm and orchard of my own for years, and always considered 'Maggie' a good friend. I never knew the Magpie to do any harm, nor interfere with the fruit, or grain crops. A few blades pulled up, were only caused by their foraging for insect pests. I never knew them to do any harm to garden or farm, but rather the reverse, and consider they should be protected to the utmost, and would like to see destroying them severely punished. I know other growers who consider the Magpie a real friend, and would not allow them to be shot. We need strong protective legislation to preserve many of our birds from destruction."

Aphis attacking Wheat.

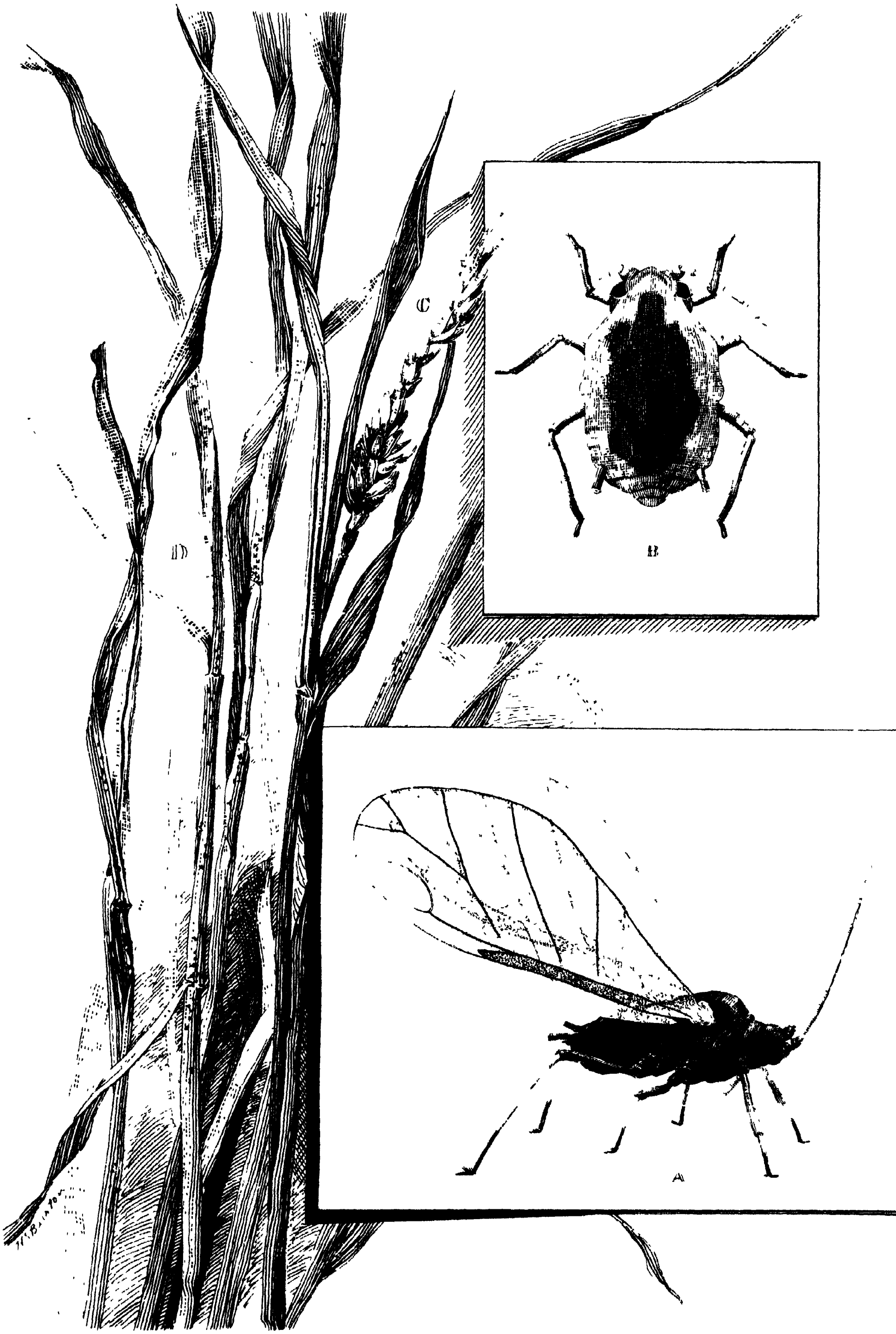
WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

SOME years ago I wrote an account (published in the *Gazette*, 1901) of wheat being damaged by aphis attacking it early in the season in the Carrathool district. In this case the wheat stalks were well grown, and produced good, healthy, heavy ears of grain; but, in consequence of the weakening of the stem under the leaf sheath, where the aphids had formed their colony, when the first strong wind came over the plains hundreds of fine heads snapped off and fell to the ground, where they were lost to the harvester. We have since had several reports sent in to the Department of isolated patches of wheat becoming more or less infested with aphis, but it has always been confined to rank growth on light sandy soil, and never spread very far afield.

The present season, in regard to wheat growing, has been a very exceptional one, for nearly all over the State the end of summer was followed by copious rains, which enabled the farmers to get their ground ploughed and crops sown early;—the later rains brought them up early, so that much on the lighter soil came up thick and flaggy. Then came a long dry spell followed by cold bleak winds, cold weather, and frosty nights; in consequence, as the moisture was gradually withdrawn from the soil the flaggy rank-growing wheat suffered most, and over a very large area round Molong, Wellington, Dubbo, and Narromine, aphis was found swarming in countless millions over the wheat fields. With this new attack upon them, the weakened wheat-stalks soon began to turn yellow and then brown, and there is no doubt that if the dry weather had continued for another month all the aphis-infested wheat would have died clean out, and the first showers would have rotted it, so that it would have been utterly valueless for hay or fodder.

To comprehend the action of aphis on wheat, we must know something about their habits. The aphis pest upon wheat is well known in Europe and England, and often does a great deal of damage, and in the latter country Warwick recorded it as a pest in 1797. The hop-growers in the South of England also at times suffer very much from the larger green species (*Phorodon humuli*). Buckton, in his Monograph of the British Aphides, quotes from a writer in the *Penny Cyclopædia* of 1802, in which it is said that in consequence of the destruction caused by the hop aphis the excise duty paid upon hops for the previous year fell from £100,000 to £14,000.

Our species is probably the common European wheat aphis; it agrees in most details, except colour and length of antennæ, with Buckton's



WHEAT APHIS.

A Winged Aphis B Wingless Form C Wheat Frost-bitten D Wheat attacked by Aphis

description and drawings; it was named by Kirby *Siphonophora granaria*; is common on wheat, oats, barley, and many different grasses; and may be also found upon very dissimilar plants and shrubs growing in the infested neighbourhood. It has been proved that aphis born upon and feeding upon some particular food-plant will starve to death before they will attack another kind of food-plant; but if the final winged forms migrate, the fresh brood produced by them will thrive upon a new host plant. This habit of the same species in following generations frequenting many different plants, and often materially changing their colour in the process, has led to much confusion in the identification and redescription of the same species under new names. As far as I know no native species have been described from this country; certainly all our common species are introduced, and have come here with their food-plant; about ten very distinct species can be collected in our gardens and upon introduced weeds. The last brood of winged aphids leave the infested wheat, which has been pretty well sucked dry by the preceding generations, and settle upon the grass, where the eggs in England pass through the winter; here they are probably in more danger from the heat of midsummer. Until it was discovered by entomologists that the wingless first generation of female aphids brought forth living larvæ, which in turn brought forth living larvæ (which, however, grew into winged males and females, the latter not producing living larvæ but eggs, which may remain for a considerable length of time without hatching), it was a mystery how the life history worked out. These alternations of generations are known to occur also among some of the small *hymenoptera* (gall wasps), when one brood is furnished with wings, but gives birth to eggs that produce wingless forms quite unlike their mothers.

In the early part of the season, under suitable conditions, before the warm weather brings out their many parasitical enemies, the multiplication of these little creatures goes on with such marvellous rapidity that they simply swarm out as if by magic, and many eminent naturalists have gone into figures to demonstrate the reproductive possibilities of a family of aphids. Professor Huxley, in his paper on "Organic Reproduction of Aphids," assuming that an aphis weighs 1-1000th of a grain, and that it requires a man to be very stout to weigh more than two million grains, goes on to demonstrate that the tenth brood of aphids alone, without adding the products of the generations that precede the tenth, if all the members survive the perils to which they are exposed, contains more ponderable substance than 500,000,000 of stout men—that is, more than the whole population of China. (Buckton.)

The first place I visited during my investigations into the aphis pest was Molong, and by the kindness of Mr. John Owens, of Manildra, I passed and examined a number of fields in and around Cumnock where the aphis had been very bad, but by a heavy fall of rain a few days before had received a serious check, and the crops that had been looking quite brown a week before were already showing a green shoot. The

ranker the growth the more had the wheat been infested, the aphis lodging under cover of the leaf-sheath and sucking the sap out of the growing stalk, causing them to die back to the stool, so that in many instances a quarter of the stalks of each stool was dead, and the yield would be considerably reduced where the whole paddock was infested in this manner; in a few patches of limited area every stalk had died back, leaving a brown rotten mass of flag and stalks upon the ground, but this was exceptional. We found the danger from the aphis was practically over with the change of the weather, and the number of parasites that were hovering over and hunting among the infested wheat—syrphid flies (*Syrphus viridiceps*), small braconid wasps, smaller parasites, and an ichneumon (*Bassus lætatoruis*), that, though it has all the habits of a useful parasite, is a deadly enemy to the more useful syrphid fly, depositing its eggs in the naked larvæ—were all very abundant, and we would at a glance see where we could still find aphis by the number of insects flying over the spot. Driving back in the evening we met great swarms of the tiny black-winged aphids, flying in our faces and covering our clothes. These had evidently come off some of the infested fields. From Wellington I visited Comobella and Bodangora, where very similar conditions existed, and the aphis had done the same kind of damage to most of the early crops.

Wheat attacked by Aphis.

In the Narromine district the crops in many places were very brown, but the aphis had apparently left the wheat at a much earlier stage than in the more eastern districts, and though the wheat in some of the paddocks looked much browner, it was the flag that was chiefly dead and not the wheat-bearing stems, which had shot up later, and, except in the very early wheat which had been burnt with the frost, they were bearing good heads.

There are a number of conclusions to be arrived at in considering this subject, among them the alteration in the natural conditions of the

country when the whole district is denuded of its timber and scrub. When the wheat fields were scattered it is probable that the clearing of patches among the timber did good, both to the freshly opened up land and the adjoining forest, but when clearing becomes universal the land is exposed to wind storms and much more subject to frost. In the orchard districts of the county of Cumberland fruit-growers have found that as long as their orchards were protected by the adjacent forest and scrub (if not too close to the fence) they did very much better, and were less subject to frost than now when the whole of the timber has been swept off on all sides. Obscure diseases are now rife that were unknown twenty-five years ago, and some of them could be probably traced to the altered conditions of their surroundings, if we had enough data to go upon. The best grown and best cultivated wheat is the most hardy under ordinary conditions. The man who gets his wheat in early generally gets it above ground first, and in the western country the early crops are the standby for the farmer; when he has late-sown wheat it is generally rushed in on the off chance that the season may be late, and he "might get something off it; it didn't cost much to scratch in, so it won't be much loss." When, however, a pest appears which attacks the main crop—and we must bear in mind that the action of the aphids causes the plants to fall and rot, giving birth to fungus growths and mildew, so that it is useless for hay or fodder if once badly infested—the outlook is a very serious one. The climatic conditions of this last season were very unusual, but they might occur next year or any other season, and if the rain hung off a month longer it would mean the total loss of immense areas of wheat.

It is not practicable to treat a field of wheat when the aphis is in it, nor can any precautions be taken to keep them out, but by clearing up the paddocks and ploughing in all stubble, or burning it off beforehand, if there are any aphids left in the egg or larval state about the ground they would be destroyed. Any rank grass in the district near the wheat or fallow lands, if found to be a resting place for aphids, should be eaten off, for we know that in England they lay their winter eggs on grass. I do not think, however, that there is much occasion for alarm, as it is very unlikely that we shall have next season like the present one, and with normal winters the aphis will not make much headway. The parasites of aphids have been studied from a very early date, and are always found in conjunction with them; they are cosmopolitan, and have come to us from abroad, the native home of the aphids, and are in every sense of the word true "natural enemies." The wheat aphis is infested by its naturally introduced enemies, supplemented by many Australian helpers, but the damage is done to the wheat before they enter into action; they only check the abnormal increase that, if left uncombated, would, as Huxley's calculation proves, cover the face of the land with a smothering mass of aphids.

The cabbage aphis, in a like manner, with its natural enemy, a small

braconid, described in England many years ago by Curtis, is very abundant. At Albury this summer we found the Victorian cauliflowers coming over the border swarming with cabbage aphis, crawling over the floors of the trucks, and half smothering the men transhipping them; but at the same time the other leaves were coated with dead aphids, brown, dry, and distended, each containing a parasite. We imported millions of these into this State that morning; but it does not alter the fact that, while we can find aphis and parasite late in the season, working side by side, the cabbage aphis is with us in every cabbage garden in Australia if the climatic conditions are adverse to the healthy growth of the plants, and this will always be the case. The peach aphis has many natural parasites, and the later broods are cleared off by them in a wonderful manner (some of the parasites in turn meeting their fate at the hands of other parasites).

I have counted 400 ladybird beetles (*Leis conformis*) on the trunk of an apple-tree covered with woolly aphis, on a summer morning, in an orchard at Mittagong, but the following winter, when the rains came, the tree was again festooned with the white woolly secretion of the aphids, and they were as thick as ever.

Wheat Harvest of 1905-6.

Readers of the *Agricultural Gazette* who are good enough to furnish periodical crop reports to the Government Statistician will find in this issue a form, which they are requested to kindly fill up and return, so as to reach the Statistician's Office by the end of the year. The forms have generally been returnable about the middle of this month, but this year Mr. W. H. Hall, the Acting Statistician, has decided to delay the publishing of his report until early in January next.

It is hoped on this account that crop reporters will be able to give even more reliable information than heretofore, although, owing to the dry weather conditions experienced in many districts, and the lateness of the harvest generally, special care is enjoined when estimating those crops which have not been harvested before the report is sent in.

Reporters will confer a favour if they hold over their returns till the end of the month (say, the last week), so as to give Mr. Hall the benefit of the very latest particulars when he is compiling his estimate of this season's crop.

For the convenience of those who are kind enough to furnish the desired information, the forms are stamped and addressed ready for transmission through the post.

Forestry in New South Wales.

University of Sydney—Extension Lectures.

[A lecture delivered by J. H. Maiden, Director of the Botanic Gardens, at the Royal Exchange, Sydney, Wednesday, 13th September, 1905.]

I AM invited to give one lecture on "Forestry in New South Wales." A course of six could but touch the fringe of the subject. My difficulty is, therefore, to know what to leave out, and all that I can offer you in the space allotted to me are pointers. I trust, however, that what I present to you to-night may afford food for reflection, and if I can cause you to take a greater interest in thisim portant national subject, my discourse will not have been in vain.

Uses of Forests.

First of all, what are the uses of forests?

These may be classified under various heads :—

1. Value of timber.
2. Value of minor forest-products.
3. Protection against winds :—
   (*a*) Affecting the comfort and health of men and animals.
   (*b*) Affecting crops, *e.g.*, cereals, fruit-trees, gardens.
4. Protection of land :—
   (*a*) From coastal and inland sand-dunes.
   (*b*) From the breaking down of the banks of streams.
   (*c*) From the gullying and stripping of hill-sides.
5. Regulation of rainfall.

All forests whose existence is continued for reasons other than for the direct conversion of the material of which they are composed into saleable articles are called "protection forests," and we have the right to take credit for them, even if they do not yield a stick of timber. The State forest balance-sheet is presented thus: Cost of the administrative staff, so much; cash paid into the Treasury, from timber (chiefly), so much. These items may be in debit or credit. I do not say that the State forestry accounts can be kept in any other way, but I appeál to citizens to take a broad view of the utility of forests. I go so far as to say that if it were not for her forests, New South Wales would be a desert, and existence would be difficult, if not impossible, for a large number of her not over-abundant population.

So far I have omitted the æsthetic aspect of forests. Æstheticism is inseparably bound up with the health of the mental, and even the bodily, faculties. I have no time to dwell upon this interesting subject, and will content myself with the statement that I cannot conceive of a race of human beings whose minds are not elevated by contemplation of forests.

Turning to the "Forests and rainfall question," I must content myself with a brief statement. We want to carefully separate two issues.

1. The effect of forests and other vegetation in increasing the rainfall.
2. The effects of the same in conserving moisture.

Let us ponder over the vastness of rainfall conditions. The conditions for a fall of rain may originate in a distant part of our planet. The monsoons make or mar our climate. Our pigmy trees and forests do not count in the vastness of origin of our rain-storms.

But the utility of forests as conservers and equalisers of the rain which falls upon a country is proved by anyone who will consider the subject. They temper floods, and aid in the more even distribution of rain which has fallen. They prevent the immediate running away of the rain, and what we often want is for rain to stay with us, a welcome guest, instead of being in a precipitate hurry to depart to lower levels, or to be dissipated by evaporation.

The Conditions of Existence of Forests.

If we look down upon a piece of virgin country from, say, the top of a high hill, we may classify it into woodland, grass-land, or desert. Turning to woodland, we may have it in large masses, or it may simply form the fringe of a stream.

The above three formations are technically called climatic formations, since their character is governed by atmospheric precipitations—usually rain.

Woodland is constituted essentially of woody-plants, and is termed forest if the trees grow in a closed condition. Woodland and grass-land stand opposed to each other like equally powerful and hostile armies striving for mastery. They are in a state of more or less stable equilibrium. An illustrative instance is the Dorrigo, with its dense forest abutting abruptly on natural grass-land or "plains."

There is, indeed, a constant struggle between woodland and grass-land, and but slight alteration of existing conditions may result in the transference of forest to grass land and *vice versâ*.

What is the essential for forest growth? I will use Schimper's words: "It is neither frequent atmospheric precipitation nor a rainy vegetative season that is of importance to tree-growth, but it is the continuous presence of a supply of water within reach of the extremities of the roots, and, therefore, at a considerable depth in the soil." This is the key to the situation. Trees must have access to subterranean water; and this is true, whether we are considering a closed forest; a fringing forest on the banks of a stream, where the necessary water is obtained by percolation; an open forest, the technical term to express that the tops of the trees do not touch each other; or isolated trees growing on our western plains.

Given three kinds of plants of different lengths of roots,—*e.g.*, grasses, shrubs, and trees,—in a given season, the grasses first fail, the shrubs hold out longer, while the trees hold out longest. Those who have travelled much have often come across large areas in which the subterranean water has, during droughts, shrunk even below the roots of trees, which have perished in large numbers in consequence.

So we see that subterranean water, usually, of course, directly supplied by rain, is an absolute essential of the existence of forests. Forests again react, as has already been pointed out, by conserving this necessary rain-store.

A second essential is a sufficiency of suitable soil.

Forests do not require to be artificially manured, because trees take from the soil much smaller quantities of mineral substances than field crops. According to Ebermayer, quoted by Schlich, an average forest crop—wood and leaves—requires annually about 54 per cent of the mineral substances necessary for an average field crop. Of that quantity 46 per cent. are stored in the leaves and 8 per cent. in the wood. The leaves and branches are usually left in the forest, hence it is that trees but little exhaust the soil, and so the better classes of soil are generally allotted to the production of agriculture and the inferior soils to forests.

Ringbarking.

It is obvious that in a sparsely-populated and fairly-well timbered country, such as New South Wales is, our forestry methods must have two objects in view—(1) the removal or ringbarking of all timber except such as is desirable to leave for the purposes of agricultural or pastoral settlement; (2) the exploiting of permanent forests on conservative lines, *i.e.*, with a view to secure the permanence of the supply—this is forestry.

As regards ringbarking, which is, of course, largely necessary, I have publicly drawn attention to the empirical methods at present adopted in this State. We should control it in regard to the following points:—

1. Proper time to minimise suckering.
2. Valuable timber and shade trees should not be unnecessarily sacrificed.
3. The position of a tree with respect to the natural get-away of water in a particular paddock or mountain side should be considered.

Forest-practice.

Pinchot wisely says that the fundamental idea in forestry is perpetuation of the forest by wise use, and he defines the four fundamental laws of good forestry:—

1. Protection against fire, overgrazing, and thieves.
2. Strong and abundant reproduction, otherwise, like a family without children, it will die out.
3. A regular supply of trees ripe for the axe.
4. Growing space sufficient for every tree.

I can only briefly touch on a few points of forest-practice, which specially appeal to us, viz., conservation and planting and transport of timber.

Conservation, not Planting, mainly required in New South Wales.

This country requires conservation of forests rather than formation of new plantations. The initial cost of careful planting of young trees can only be justified in exceptional circumstances. Some well-meaning friends would urge us to establish plantations of soft-woods, *e.g.*, the pines of the Baltic

and North America, the Redwood of California, &c., but our climate conditions are so different to those of their native countries that we cannot hope to compete commercially in the production of such timbers. Ours is a country which naturally produces hardwood, and it seems to me that we should promote the growth of the best of these, and rely upon the competition of trade to supply us with soft woods in exchange. Of course, if expenditure of money be no object, we can establish plantations of soft woods, but to secure this we may require to utilise land adapted to agricultural purposes, and to expend funds on nursing plants for which the commercial returns will be inadequate. In a country such as ours, in which the functions of government are so extensive, it is sometimes desirable to ask oneself the question, "Would I incur this expenditure on private account?" I am referring now to the question of the cultivation of soft woods. But I would certainly make experimental plantations of Silky Oak (*Grevillea robusta*) in some of the drier districts, which experience has already shown suitable to it, and the Red Cedar (*Cedrela Australis*) should be judiciously replanted in country from which it has been well nigh exterminated.

We are often told that planting is the principal occupation of a forester, and India is often quoted as the country whose example we should follow in this respect.

In European countries conservation, as opposed to planting, is more actively carried on than is usually supposed.

It is a fact, also, that but little planting takes place in India, conservation being the watchword there. As regards South Africa and South Australia, for example, they are comparatively treeless countries, and planting is the principal operation there.

Perhaps many of us agree with the emphatic words of Dr. Johnson, "There is a frightful interval between the seed and the timber. He that calculates the growth of trees has the unwelcome remembrance of the shortness of life driven hard upon him. He knows that he is doing what will never benefit himself; and when he rejoices to see the stem arise, is disposed to repine that another shall cut it down."

These views are sound in the main, but while they weigh with private citizens, they should not unduly dominate public policy, for a State, having a continued existence, can consider investments which might be unsuitable to a private citizen. Having said so much, I again repeat the conviction that at the present time our national policy should lean to conservation.

Timber Transport.

We are still in the "bullock team" era; in other words, 15 miles is, in most parts of the Coast Range country (from which by far the greatest quantity of our timber is obtained), the limit of haulage. There are a few miles of tram-rails (mostly wooden), but light railways, designed by competent engineers, to exploit the forests in a proper manner, are almost non-existent. The consequence is that timber lands more than, say, 15

miles from a saw-mill, remain practically untouched, the trees become over-matured, and the only clearing is the devastating one of the settler or bush fire. Over large areas destined for agricultural settlement, the timbers should first be utilised by the saw-miller.

The laying down of an up-to-date haulage-plant can only pay if the area of timbered lands operated upon is sufficiently extensive, and to secure the most economical methods of working such tracts, we should be prepared to lease large areas to companies or private individuals with the requisite capital.

Botany, the basis of all sound Forest Knowledge.

The European forester, as regards his own trees, has an enormous advantage over his Australian confrère. Names and knowledge of European trees have been accumulating for centuries, and the twentieth century forester starts with a mass of exact knowledge ready to his hand.

But what is the position of the Australian forester? His trees are mainly those of the genus Eucalyptus, one of the largest and admittedly one of the most difficult genera in the whole world. He has not only to administer these forests, but to carry on research work in regard to their components at the same time. The work is even now so unfinished that, as regards New South Wales, not a single year passes by without a new tree being discovered. What a sensation would be created in Europe if a new European tree were brought to light! And how difficult it is to add to our knowledge in regard to the properties and uses of European timbers.

We are indebted to the patient research of the botanist or dendrologist for the lion's share of the exact knowledge we enjoy of Australian trees to-day. His botanical names afford food for witticisms, but what other names are available in lieu of them?

The work of the engineer is largely an exact science. Is the botanist-dendrologist to be blamed for endeavouring to make his work exact science also?

He is doing as much as possible for sparsely-populated vast Australia in a hundred years what has taken Europe over a thousand years, and in spite of all the attempted short-cuts of empirics—of the so-called practical man, often another name for the practical humbug—the only safe road is the road of thoroughness, paved with botanical research.

I speak strongly because I feel strongly. People must go into the field to study the trees. The forest disappears before the town. The key to the citadel of forest knowledge can only be in the hands of men who have devoted their energies in fair weather and foul, trudging, often heavily laden, over mountains and through valleys, to study the living trees, their habit, bark, timber, leaves, flowers, and fruits.

The Stock-taking of the National Forests.—A Forest Survey.

Foresters, in any organised system of forestry, draw up what is technically known as a "working plan."

A working plan consists of the complete data concerning a particular forest and the administrative ideas of a forester. The expression is often

used as if the working plan were confined to Europe and India. I have been urging the preparation of working plans for our forests for years. No man can form a working plan of a forest with which he is not well acquainted, and the primary difficulty that presents itself to every non-Australian is the special one of recognising the various kinds of eucalypts, so similar and yet so different. What are known also as the brush trees are also frequently difficult of discrimination.

The working plan of a forest is, therefore, dependent upon a forest or botanical survey. Its desirability is so obvious that I require only to touch upon a few points which suggest themselves, because of our special circumstances and environments. The establishment of a botanical survey need not involve the expenditure of a large sum of money, but, rather, the organisation and control of existing agencies, which may subserve the grand object in view.

But while the work may be largely voluntary, it need be none the less systematic. I have conducted an informal botanical survey on my own account for many years, but my correspondents, although many, do not represent the whole of the State, and their work has been, necessarily, of a fitful and unorganised character.

One of the matters to which attention would be given by a botanical survey would be that of ascertaining the heights and trunk-diameters of various kinds of trees, different observations being made in regard to the same species in different districts. In this way a ready index would be obtained as to the climate and soils in which various species flourish best. Note would also be taken of the sizes of abnormally large trees. If the identity of individual trees be noted, either by marks on or near trees themselves in the forest, or on the maps, it would be easy to prepare records of the rates or growth of our Australian trees, a matter of considerable economic importance and of some scientific interest, but in regard to which we possess very few data at present. In a system of scientific forestry these data are simply indispensable.

First of all, let us take stock of our forest reserves. Let them be accurately defined, and let those areas be rejected that are not required. It should be recognised that our country contains a large proportion of land unsuited to agricultural purposes; much of this is available for forestry operations. It, therefore, seems equitable that the land suitable for crops and good pasture should, if held at all by a forest department, be held only until required for purposes of settlement.

I would protect the forests at the heads of watercourses and in broken country generally. Much country of that character is of no use for agriculture, and its dedication for forestry purposes would not excite the cupidity of persons in search of land.

It has been decided to classify our forests, but no method will be satisfactory that is not based on œcological principles.

We have not, however, full data at present to make a final classification of our forests. These will be secured as our botanical survey is pushed on.

Then I would enunciate the axiom that we require to take stock of the trees upon the national property. What kinds have we? Where are they? Where do they flourish best? What is their state of maturity? For what purposes are the trees best suited? Can we answer all these questions? I fear not, and until we can do so much better than at present, I am afraid that our dealings with our forests will be based on empiricism. We ought to be in a position to inform an interested inquirer, at short notice, in what part of the country there is to be found timber best adapted for a certain purpose, and in what approximate quantity.

This botanical survey of which I have spoken will lead, by the quickest road, to an accurate knowledge of the properties of our timbers. There is no stimulus to inquiry more keen than that of pecuniary interest, and the commercial man will ascertain the value of timber for his own purpose if he be given an opportunity. For all commercial purposes there must be (1) a sufficiency of the article; (2) continuity of supply. How can a man be assured of this except by a botanical survey? He uses a piece of timber and says :—"This will do admirably for a certain purpose," or, "If I had a large supply of this timber I could utilise it at once."

I, therefore, would put the botanical survey (or whatever name one may choose to call it) amongst the very first of the duties to be undertaken by a Forest Department. Examination of our timbers can go steadily on even before a survey is made, but such examination must be fitful and incomplete until it receives the stimulus of the attention of users of timber and other commercial men actuated by self-interest.

The Forest Areas of New South Wales.

This is a subject which can only be briefly touched upon on the present occasion.

Our conditions in New South Wales as regards the distribution of forests are special. We have an extensive territory, with our population mainly settled along the coastal strip, where, indeed, our principal forests are to be found. Our forest areas are roughly indicated in the map given by me in the *Agricultural Gazette* for July, 1901.

Speaking in general terms, the rainfall of New South Wales gradually diminishes from the coast-line to her western boundary, while the altitude and denseness of the forest vegetation diminishes in a similar direction. The general forest conditions of the rich-soil gullies of the intervening mountains and elevated table-lands a good deal resemble those of the coast belt.

What is known as the Dividing Range forms a huge vertebral column, whose general direction is north and south, extending through nearly the whole length of the State. This range is roughly parallel to the coast, and at no great distance from it. As far as the commercial timbers of the State are concerned, it separates the territory into two divisions,—the first comprises the eastern slopes and the comparatively flat country, thence to the sea, which yields the great bulk of our readily available forest wealth, while the country to the west produces timber available only for utilisation in the districts in which it is grown, partly because of its inferiority of size and value (with a few

notable exceptions), and partly because of the cost of land-carriage to the coast. In considering the availableness of the western timbers, it must be borne in mind that none of our rivers, flowing east and west, are of any great length, because of the proximity to the sea of the Dividing Range already alluded to, and, therefore, the advantages of cheap water-carriage between the inland forest regions and the coast are not available.

Our trees are mainly non-gregarious in regard to individual species. Thus the coastal forests are mainly mixed forest. The cypress pine forests of the western plains and the ironbark forests from Dubbo and north-eastwards are examples of gregarious forests. The White Box of so much of the black-soil country of the western and north-western slopes is a less marked instance of gregarious forest; other examples could be presented.

That our forests have been abused in the rough and tumble of settling a new country and in dealing with trees of which the wisest were ignorant, there is no doubt; but I think the time may be said to have fairly arrived when we should look the facts fairly in the face and set our forestry house in order.

There is, however, no occasion for hysterical action. Our forests are by no means exhausted. When I was a young man I used to think that certain esteemed wild flowers were becoming extinct. I used even to think that our wasteful system of forestry, or lack of system, would do the like in regard to valuable trees. I am on the side of the angels, but it is only right to point out, as the result of extensive and systematic travel and information obtained as the result of special opportunities, that as the years roll on I am more and more impressed with the vastness of our forest resources. Trees are springing up unbidden and unknown, and we are yet ignorant of the rate of growth of some of our principal commercial trees.

One of the most important functions of a properly organised Forest Department would be the collection of data such as these which would remove the operations of the department as far as possible from empiricism.

The various kinds of Forest Trees.

The principal forest vegetation of the State consists of trees belonging to the genus Eucalyptus. Those which have smooth (or comparatively smooth) trunks are known as gums, and this term is qualified by adjectives such as white, blue, and red. A white gum has a white trunk. A blue gum has a trunk or leaves (or both) with a bluish cast. A red gum has the timber red, and so on. Others have rough bark, thus those with a rugged, hard bark (accompanied by a timber of great hardness and durability) are known as ironbarks; those with a thick, fibrous bark (accompanied by a timber which is very fissile) are known as stringybarks.

A blackbutt is a tree with a sub-fibrous bark on the butt and smooth branches. Trees with soft (often whitish) barks, brittle-fibrous or woolly are called boxes. But this is a term which should be used with caution, as the bark of the Yellow Box often inclines to be flaky, while trees called Red Box are often as smooth as a Red Gum.

The common names for the various kinds of Eucalypts are very numerous, and they vary so much in different localities, and also for the same tree, that an accurate knowledge of them can only be acquired by much travel and study.

The natural allies of Eucalyptus are the other genera belonging to the Myrtaceæ, of which the principal are Angophora (apple-trees), Syncarpia (turpentine), Tristania (brush-box and water-gum), Melaleuca (tea-trees), and Eugenia (myrtles).

The next genus to Eucalyptus in point of number of species is Acacia, which includes many trees generally known simply as wattles, or qualified by the prefix black, green, silver, golden, broad-leaved, weeping, &c. Other Acacias are known as hickory, blackwood, myall, boree, mulga, brigalow, dead finish, sally, gidgee, yarran, ironwood, and a host of other names. The Acacias rarely form forest trees of the largest size.

Amongst other natural orders yielding timber-trees are Pittosporaceæ, Tiliaceæ (yielding blueberry ash, maiden's blush, &c.), Rutaceæ (yielding many of the soapwoods, Evodia, &c.), Meliaceæ (yielding cedar, rosewood, teak, cudgerie, Long Jack, &c.), Sapindaceæ (yielding Cupanias, Nepheliums, native tamarind, &c.), Leguminosæ (including Acacia and black bean), Saxifragæ (including a number of plain, easy working, durable timbers, such as coachwood, marara, &c., belonging to the genera Ceratopetalum, Weinmannia, Ackama, &c.), the Verbenaceæ (including the white beech, the mangrove, &c.), the Proteaceæ (including a number of fissile timbers bearing a strong family likeness, such as silky oak, honeysuckle, &c.), the Monimiaceæ or Sassafras family, the Euphorbiaceæ, including some hard, dense timbers known as scrub ironbark (Bridelia), Casuarinaceæ (including swamp, forest, and other she-oaks in variety), Cupuliferæ (including a true beech, Fagus Moorei, a durable timber which would be much sought after if it were found growing in less inaccessible situations), the Santalaceæ (including the native cherry), the Coniferæ (including the cypress pine, Moreton Bay pine, and she or brown pine), and many others.

Timber—Classification and Uses.

Proposals for grading our principal hardwoods.

It is obvious that if we wish to sell our wares to advantage we must classify or grade them. The scientific classification of timbers is the botanical one. It is the basis of all classification, and I have laboured for nearly a quarter of a century to perfect it. But I am not so foolish as to expect timber-getters, saw-millers, and timber-merchants to run museums and to botanically label their stuff. The vernacular or common names are, however, distracting, so if we are to obtain a workable code of names there will have to be compromise.

In regard to some kinds of timber, I do not think there will be much difficulty. For example, the ironbarks and stringybarks are well-defined groups. Then we may divide all other timbers into pale hardwoods and red hardwoods. Amongst the pale hardwoods, Alpine Mountain Ash, Tallow-wood,

and Spotted Gum cannot be confused by any practical man. Bloodwood is a valuable and durable timber of a red colour, not likely to be confused with anything else.

Blackbutt.—I would make this term include—

Eucalyptus pilularis (the true Blackbutt).
acmenoides and *umbra* (two kinds of White Mahogany).
goniocalyx (Mountain Gum).

Pale Box.—I would make this term include—

(White or Grey Box.)
Eucalyptus hemiphloia.
Baueriana (Fuzzy Box).
Bosistoana (South-Coast Box).
quadrangulata (A Box).
melliodora (Yellow Box).

Fissile specimens of the pale boxes may approximate in texture to the Blackbutts.

Jarrah.—I would make this term include—

A. *Eucalyptus punctata* and *propinqua* (Grey Gums).
resinifera (Forest Mahogany).
longifolia (Woolly Butt).
saligna (Blue Gum).

B. The Red Boxes.
Eucalyptus polyanthemos (Red Box or Slaty Gum).
Rudderi (Coast Red Box).
bicolor (Black or Flooded Box).
fasciculosa (Western Red Box).

C. The Red Gums.
Eucalyptus rostrata (River Red Gum).
tereticornis (Forest Red Gum).

There is no hard-and-fast line between the Red Gums and the Red Boxes, nor between them and the timbers I enumerate in list A. I propose indeed, as a practical classification, to call them all—viz., lists A, B, C—Jarrah.

The true Jarrah is *Eucalyptus marginata,* and is confined to Western Australia. The timbers enumerated are equal to and, in my opinion, in some cases (*e.g., E. resinifera* and *E. saligna*) superior to Jarrah, so that the grading of these timbers under the name of Jarrah will not lower the grade of the timbers bearing that name. It is well known indeed, that in Europe the above timbers have been used on the market as Jarrah for many years.

Some West Australians may say that my suggested use of the name Jarrah is immoral, but I reply that there is much laxity in the use of names for timber in Australia, and we must federate somewhat to minimise the evil. For example, the West Australians have a timber they call Red Gum, which name came into use long after the same name was applied to a much

superior timber in Eastern Australia. In adopting the name Jarrah for certain Eastern Australian timbers I am simply conceding the fact that the term has become generic for certain red timbers in the home market.

It will be observed that I have excluded such timbers as the peppermints, apples, the numerous white and swamp gums, coolibah, &c., which by reason of their inferiority or distance from markets, are used strictly for local purposes. My list, of course, may be added to or diminished ; I desire to use it for illustrative purpose, and do not wish it to be looked upon as a complete list.

Under the various groups, *e.g.*, Ironbark, Blackbutt, &c., it will be observed that I have classified two or more timbers. If it be objected that here we have timbers of different qualities, then my reply is, that timber like other raw products is sold according to grade. Butter, for example, an article whose composition and quality are more uniform (I should imagine) than the heterogeneous substances known as Australian timber, has many grades in the wholesale trade. What, therefore, is the practical difficulty in grading the Blackbutt group A, B, C, &c., or 1, 2, 3, &c., according to quality?

As a matter of conscience, I do not think that Government should interfere with the course of trade where the work can be safely left to private enterprise, but I think that for many a long day, until knowledge of our native timbers is far more widespread and accurate than at present, Government grading of timbers should be carried out. What we have to guard against is the injury which exporters have done the timber trade in the past by shipping, through ignorance or otherwise, inferior timbers which simulate those of better quality and under well known names.

In saying this, I express the opinion that Government inspectors of timbers for export have in the past performed their duties under the most disadvantageous circumstances. They have had no proper facilities for identification of certain timbers, and, as most of us are well aware, the men with wide and accurate knowledge of Australian timbers are very few, simply because little encouragement has been given to proficiency in this special branch of knowledge.

One *sine quâ non* is that on every wharf in Sydney or other port where timber is inspected, there should be a set of authenticated Australian timber specimens to guide the expert, and to enable him to point out the characters of timbers to those who may challenge his ruling.

I have drawn attention to the regrettable empiricism which obtains in regard to our forests: surely there is just as much quackery in regard to timber determinations. I think this points to a very serious deficiency in our scheme of technical education.

As we have examinations for mining men and wool men, who have obtained their special knowledge, partly in mines or wool-sheds and partly in the class-room with practical demonstrations, so, as regards Australian timber, I would utilise the resources of our technological museums and technical colleges, and would award the diploma of "timber expert" only to those found to possess a thoroughly sound knowledge of the subject. If

timbers for export were alone passed by competent men, an impetus would be given to the study of our native timbers which I think could be obtained in no other way.

This reform obtained, I would work for a further one. That is to enable buyers of timber to obtain certificates in regard to the Australian timber they purchase. At the present time a buyer is, in ninety-nine cases out of a hundred, entirely at the mercy of his timber merchant. He obtains expert advice, perhaps, as to the best timber to order for a specific purpose, but whether he gets what he orders is quite another matter.

The buying of timber per certificate is, in my view, a reform badly wanted. I would even extend it to firewood, for there is much jugglery in the firewood trade. The rich man can usually buy the best, but the people of moderate means and the poor are those who, in large towns, pay an exorbitant price for fuel of little value for heating purposes, and who are precisely those who are grossly ignorant of the various kinds of timber. They are, indeed, entirely in the hands of the rapacious and unprincipled wood-dealer.

I do not, however, suggest that there is no swindling except in the firewood trade. A couple of stanzas from Kendall's "Jim the Splitter," seem very much to the point:—

> He splits a fair shingle, but holds to the rule
> Of his fathers, and, haply his grandfather's school;
> Which means that he never has blundered,
> When tying his shingles, by slinging in more
> Than the recognised number of ninety and four
> To the bundle he sells for a hundred.
>
> When asked by the market for ironbark red,
> It always occurs to the Wollombi head
> To do a "mahogany" swindle.
> In forests where never the ironbark grew,
> When Jim is at work, it would flabbergast you
> To see how the ironbarks dwindle.

[The lecture was illustrated by about sixty lantern slides.]

Lucerne—Bathurst District.

R. W. PEACOCK.

Too much cannot be written of this valuable fodder plant. From the owners of all classes of live stock it demands attention. It is not as generally grown as its value warrants. Amongst many farmers and stockmen there is a mistaken idea that it will grow only upon the first-class alluvial soils. Under proper management, it gives excellent returns from a diversity of soils and under varied conditions. As a suitable crop from which to make provision for stock for periods of scarcity, lucerne has no equal. It can be kept for several years in the stack without seriously deteriorating. No farm should be without an acre devoted to it. It has an important place in a profitable system of crop rotation. In mixed farming, it is valuable for horses, cattle, sheep, pigs, and poultry.

Varieties.

The variety most worthy of cultivation is the common or European lucerne, *Medicago sativa*, and the one mostly cultivated in this State. A variety of French lucerne, *Medicago media*, was introduced a few years ago, and is supposed to be a hybrid of the common lucerne and a clover. It is not so robust as the former, and does not yield as heavily. It was claimed that it grew better than the common variety upon the light soils.

Turkestan lucerne, *Medicago sativa Turkestanica*, was obtained in rather large quantities by the United States Department of Agriculture from Turkestan. It was reputed to be more drought and cold resistant than the common variety. Several strains of this variety are at present under observation at the Bathurst Experimental Farm.

Soils suitable for Lucerne.—The soils best adapted for its growth are the rich alluvial deposits along rivers and creeks, having a supply of free water 15 to 30 feet below the surface. Such deposits should be loamy rather than stiff, allowing of free penetration of the roots, and natural drainage. Heavy clays are unsuitable. Strata of coarse gravel and stones between the surface and the free sub-moisture should be avoided, as the connection between the surface and sub-moisture is severed, the roots being unable to reach the water-level, from which to supplement the surface rainfall. Under favourable conditions the roots may penetrate 30 or 40 feet to the water-level, thus allowing of considerable growth during periods of limited rainfall. Considerable advantage under certain conditions is derived from the action of its vigorous root system, the soil being thoroughly subsoiled and sweetened by such agency. Upon soils such as the above, the yield is considerable, as many as six or seven cuttings being made in one season, aggregating 5 to 8 tons of cured hay per acre. Upon the lighter soils of the uplands, such as the

typical wheat lands, it may be grown profitably. There being no free water available at a reasonable depth under such soils, it is dependent solely upon the rainfall for its moisture. In a favourable season two light cuttings may be taken, and the area grazed for the remainder. It is for this latter purpose that it is so valuable upon such soils, and provides an acceptable green bite when the natural pastures are brown during the summer. I know of no perennial fodder plant that will give the same returns from such soils. As a subsoiler and soil renovator it excels, and is, therefore, valuable in a rotation.

Preparation of the Soil.

The preparation of the soil should be thorough; it is extremely impatient of slip-shod methods. It being a perennial, and known to give fair results upon the best soils twenty-five years after seeding, it naturally pays for liberal treatment to ensure a vigorous stand. A poor stand is most disappointing; weeds take possession of the bare land, and heavy yields and good clean hay cannot be expected. Where weeds are likely to prove troublesome, a cleaning crop, one requiring frequent cultivation, should precede it, such as maize, potatoes, &c., care being taken to cut out all weeds. A comparatively free working loam should be ploughed 7 or 8 inches deep about three months' before seeding time, to allow of the inverted subsoil to mellow and sweeten. If the subsoil be heavy, a subsoil plough could be used to advantage, the land being stirred from a foot to 15 inches deep; such increases the retentive power of the soil for moisture, which is important to help the seedlings over their initial difficulties. Prior to seeding, the surface should be brought into a good tilth and all weeds killed, by plough, roller, and harrows. The seeds being small they should not be covered deeper than from ½ to 1 inch. This cannot be ensured when the surface is rough. All furrows should be filled in by cultivation, and the ridges smoothed to facilitate the use of harvesting machinery.

Seed per acre.

Upon the rich alluvial deposits from 15 lb. to 20 lb. per acre should be sown. A thick stand is desirable to ensure small stems with a large proportion of leaf, these being essential for a good hay. Upon the lighter lands from 10 lb. to 12 lb. would be a desirable seeding. Care should be taken to obtain good seed, free from weed seeds, especially those of the parasite dodder. The dodder seeds are much smaller than those of lucerne, and are readily removed by screening. Lucerne attacked by dodder should never be cut for seed. The seed may be sown by hand or any of the machines designed to sow small seeds. If by hand it would be wise to sow half of the quantity in one direction and the other half casting across the first sowing to prevent any possibility of missing strips, which is often the case with the most careful sowers. In general practice it is preferable to broadcast the seed. Where troublesome weeds are apt to choke the plants, or moisture is so limited as to necessitate frequent cultivations, sowing in drills is preferable.

Covering.

The seeds should be very lightly covered, and to ensure this a lever-harrow, with the teeth sloping at an angle of about 45 degrees backwards, should be used. If an ordinary harrow be used, some bushes or other material should be placed between the teeth to prevent them entering the soil too deeply. It can be covered very well by a drag of green bushes instead of the harrow. When the surface needs consolidating, a roller should be used after sowing, to be followed by the harrow. The surface when left smooth by the roller is apt

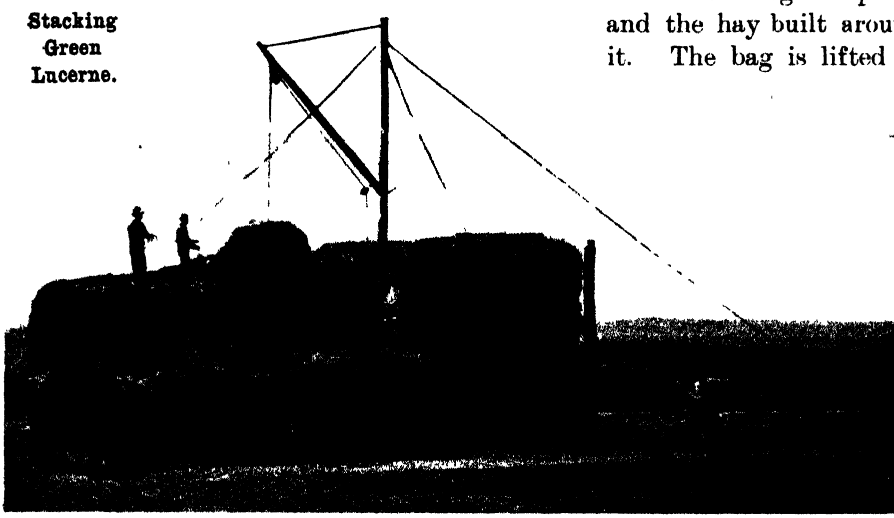
A month's growth of Lucerne under Irrigation, Bathurst Experimental Farm.

to crust after rain, and moisture is also lost by evaporation, which generally cannot be spared. The best time to sow is in the early autumn, preferably about March if germination can be assured. The plants get well established during the winter and early spring, and are enabled to withstand the dry summers which are invariably the rule. In seasons of sufficient moisture throughout the summer, spring sowings are successful, but, generally speaking,

such conditions do not exist, and the autumn seeding is preferable. It is sometimes the practice to sow wheat, oats, or a similar crop, as a cover crop for the young lucerne. Such practice cannot be too strongly condemned, as generally all the moisture is required for the lucerne. The young lucerne plants are also drawn and weak in their endeavour to get to the light, and lacking in sturdiness and vigour, which are essential. The young plants should be cut early in the spring, as soon as the mower can get hold of them. This checks any weeds which may appear, and if the season turns dry they are better able to withstand it. If a dry summer is feared, it is wise to leave the first cut upon the land to act as a mulch. Such practice helps the crop to weather through its most critical stage. This would interfere with the quality of the hay which might afterwards be gathered, but during dry summers the advantage from the mulch far outweighs the depreciation of the succeeding crop. During the first year much must not be expected excepting under very favourable conditions, or when under irrigation. Lucerne being a summer crop is practically dormant during the winter. Upon the advent of warm weather it grows quickly, and is ready for the mower about the end of October. At this season of the year the weather very often proves unfavourable for haymaking, and owing to the first cut usually containing weeds, it is good practice to make it into ensilage. If required for ensilage, it can be cut earlier, and should be carted direct to the stack or pit, and not allowed to wilt. It can be carted in showery weather, but carting when very wet is not advisable. By cutting early and making it into ensilage the second cut is ready before it otherwise would be, and during weather suitable for haymaking. For hay it should be cut as the first flowers appear, which is usually about six weeks after the preceding crop is cut. If left longer the lower leaves turn yellow and fall off, the stems becoming coarser and the resultant hay inferior. In mowing, the crop should lie evenly over the ground, and the swathboard should not be used if it can be cut without. In very heavy crops and the soil damp, it may be advisable to turn the crop over whilst in the swath to allow the sun to act upon the under surface, otherwise it will be unevenly wilted and may also turn yellow. The field should be cut in narrow strips to allow of evenness of wilting, and the horse-rake when gathering should cross the swaths. If the rake runs with the swaths and the crop rather dry, considerable leaf is lost by the stems running through the teeth of the rake. To prevent waste of leaves, extreme care is necessary. It should be raked on the tough side rather than when too dry. If very dry, it would be wiser to defer raking until daylight the following morning. After raking into wind-rows it should be cocked with care, so as to prevent waste of leaf, and in building the centre of the cocks should be kept highest, so as to enable them to turn a shower. If well wilted the cocks may be of a fair size but not too large; the curing process goes on more quickly in small heaps, and it would be ready to stack earlier than when stacked in large ones. Small cocks have the disadvantage of offering a larger surface to the bleaching effects of dews and showers. In very favourable hot weather the hay may be stacked three or four days after cutting. In the earlier and later parts of the season it may take from one week to a

fortnight. It is important to get it cured as quickly as possible, as rains and heavy dews interfere considerably with its quality. When the weather is unfavourable, and the hay carted on the soft side, it is wise to make narrow stacks, so that the curing will go on after stacking. Well-cured hay in the field can be stacked safely in broad and large stacks. In the spring or autumn it is frequently difficult to cure the hay, and it has of necessity to be stacked on the soft side. To prevent undue heating, narrow stacks are built, and flues can be put in to advantage. These latter are easily made, by first laying two posts or logs, 6 or 8 inches thick, parallel to each other, and about 6 inches apart, on the ground, and long enough to reach the middle of the stack. A few sticks are placed across, to prevent the straw or other material used for the stack bottom from blocking the air-channel. A chaff-bag full of straw or chaff is then stood upright over the end of the logs or posts, and the hay built around it. The bag is lifted as

Stacking Green Lucerne.



the building progresses until finished. An air-channel is thus left from the outside of the stack at the bottom, and upwards through the middle, the outlet being in the roof. A few such flues in narrow stacks are helpful under certain conditions, but should only be used when the weather does not allow of sufficient curing in the field. Well-made hay retains its leaf and rich green colour. After the haymaking season is over, it may be grazed lightly throughout the winter, but the plant will last longer if stock are not turned upon it. During August the stock should be taken off, and the surface thoroughly cultivated, to loosen it and destroy weeds. A most efficient implement for the purpose is the "Lucerne Digger and Cultivator," patented by Messrs. Wilton Bros., of Mudgee. Ordinary cultivators, with very strong, narrow tines, as well as disc-arrows, are also used. When the soil is tramped tightly around the plants by stock, it becomes a more efficient conductor of heat, and the increased temperature of the soil in hot climates very often destroys the plant. The cultivated surface remains much cooler, and in hot districts a loose surface is very desirable.

Lucerne under Irrigation.

To irrigate lucerne efficiently and economically, the land should be graded into perfectly-level checks. The size of the checks are determined by the conformation of the ground, its porosity, and the water supply. With a fairly large water supply, 1-acre checks are convenient. It is impatient of stagnant water, and the water should not be allowed to lie on the plots longer than twenty-four hours. In the hot weather it is wise to irrigate about ten days after cutting, when there is sufficient growth to prevent the scalding of the very tender leaves, excessive evaporation, and crusting of the surface. One thorough watering between each cutting is sufficient. It may be cut as frequently as every four or five weeks.

Value as a Fodder.

Lucerne is an extremely valuable fodder for all classes of stock. When fed to cattle and sheep care must be taken, as they are very likely to suffer from bloat or hoven. For this reason it is best to feed to such as hay. It is best fed in conjunction with cereal hays or grasses. It is very valuable for milch cows and breeding ewes, as it increases the milk supply. It contains a large proportion of proteids and lime, essential to flesh and bone production. For this reason it is valuable for young, growing animals. Stock should be brought from other foods on to lucerne gradually, or otherwise digestive troubles may occur. It is laxative and diuretic, and is one of the most valuable fodders during droughts, when green grass is not obtainable.

Lucerne, in common with other leguminous plants, is able by means of bacteria to fix the free nitrogen of the atmosphere in its tissues. By growing lucerne the nitrogen in the soil may be increased. It is for this and other reasons a valuable crop in a rotation. Upon light soils it responds to applications of manures containing phosphoric acid and potash.

On account of its many sterling properties, it is desirable that its cultivation should be extended.

Farmers' Fowls.

[Continued from page 1106.]

G. BRADSHAW.

CHAPTER XXII.

Judging Orpingtons.

HAVING now shown and traced the history of the Orpington from the time the late W. Cook conceived that there was a vacancy for such a breed until the last variety originated, it is now opportune to give the type or shape, size, colour, and other characteristics which go to make perfect specimens of the breed. It may be said that the shape of a fowl or the colour of its plumage need not trouble the farmer whose consideration is eggs and meat for his household or the market. There is certainly some reason in the contention, but largely superficial, for just as was remarked when treating on Wyandottes, the most perfect specimens of the breed will, if not carefully mated, very shortly deteriorate, and become a flock bearing little similitude to their progenitors, for it must be recollected that all the outward qualities of the Orpingtons, and inward as well, were first the result of crosses, and the continuous selection year after year of specimens that possessed the desired qualities in the greatest excess. Then when all these were at last found combined in a certain family, standards based largely on the characteristics of this family, or even on a higher ideal were formed, and by these standards the birds when exhibited are expected to be judged, and whether the farmer exhibits his fowls at the local show or not, it will be incumbent on him that while his object is eggs and carcases, he must keep in view the fact that except thought and experience be brought to bear in the mating and breeding, his stock of Orpingtons will soon be that in name only, and in order to show the utility man, and the exhibitor as well, the special points and requirements of the several varieties of this breed, the standards issued by the British Poultry Club are appended. The excellent illustrations executed by the Department's artist will largely assist in the interpretation.

General characteristics of cock:—

Head and neck.—Head: Small, neat, fairly full over the eye, carried erect.
Beak.—Strong, and nicely curved.
Eye.—Full, bright, and intelligent.
Comb.—Single or rose. The single comb to be of medium size, erect, evenly serrated, free from side sprigs. The rose comb should be set straight and firmly on the head, full of fine work or spikes, free from hollow in centre, and narrowing behind to a distinct peak lying well down to head (not sticking up).
Ear-lobes.—Medium size and rather long.
Wattles.—Medium length and well rounded.
Neck.—Nicely curved, with full hackle.
Body.—Breast: Broad, deep and full, carried well forward, long straight breastbone.
Back.—Short, with broad shoulders.

Saddle.—Rising slightly, with full hackle.
Wings.—Well formed, and carried close to the body.
Skin.—Thin and fine in texture.
Flesh.—Firm.
Tail.—Medium size, flowing, and inclined backwards.
Legs and feet.—*Thighs*: Short.
Shanks.—Short and strong.
Toes.—Four in number, well spread.
General shape and carriage.—Cobby, and compact; erect and graceful.
Size and weight.—Large. Between 9 lb. and 10 lb. when fully matured.
Plumage.—Close.

General characteristics of hen :—

Head and neck.—As in the cock.
Body.—*Breast, back, and wings*: As in the cock.
Cushion.—Small, but sufficient to give the back a short and graceful curved appearance.
Skin and flesh.—As in the cock.
Tail.—Medium size, inclined backward and upward.
General shape and carriage.—As in the cock.
Size and weight.—Large. About 7 lb. or 8 lb. when fully matured.

Colour in Black Orpingtons :—

In both sexes.—*Beak*: Black.
Eye.—Black, with dark-brown iris.
Comb, face, ear-lobes and wattles.—Red.
Shanks.—Black.
Skin and flesh.—White.
Plumage.—Black throughout, with a green sheen or lustre upon it, free from coloured feathers.

Colour in Buff Orpingtons :—

In both sexes.—*Beak*: White or horn colour.
Eye.—Red or brown, the former preferred.
Comb, face, ear-lobes and wattles.—Red.
Shanks.—White.
Plumage.—Any shade of buff from lemon buff to rich buff, on the one side avoiding washiness, and on the other side a reddish tinge. The colour to be perfectly uniform throughout, allowing for the greater lustre on the hackle and saddle-feathers, and of the wing-bow in the case of the cock only.

Value of Points in Black Orpingtons, cock or hen.

Defects.	Deduct up to. Points.
Defects in plumage and condition	10
,, head, 5; comb, 7; face, 5; beak, 3; eye, 5	25
,, breast	10
,, saddle or cushion and back	5
,, tail	5
,, legs and feet	5
,, skin and flesh	5
Want of shape	15
Defect in carriage	10
Want of size	10
A perfect bird to count	100

Value of Points in Buff Orpingtons, cock or hen.

Defects.	Deduct up to
Defects in head and comb	10
,, colour	35
Want of shape	20
,, size	10
Defects in legs and feet	15
Want of condition	10
A perfect bird to count	100

Serious defects for which birds should be passed.—Other than four toes; wry tail or any deformity; the slightest feather or fluff on legs or feet; long legs, yellow skin; twist or side spikes in comb, or comb over to one side; yellow in legs or feet. *In Blacks.*—Any coloured feathers. *In Buffs.*—Any white, or much black in tail or flights; legs any colour but white.

When the above poultry clubs standards were compiled and issued in 1901, the White Orpingtons had made no headway in England, and were not included in the standards; however, during 1904, and the early part of this year, the Whites and Jubilees were receiving more attention, and, as is usual in England, when a breed is likely to catch on, a club is formed, a standard formulated, and encouragement given to exhibitors in the way of special prizes.

In the early months of the present year one of these was formed in England, called the Variety Orpington Club, which, shortly after its formation, drew up and published the following standards. Such is not yet ratified by the English Poultry Club, but there is scarcely a question but it will be when presented.

Colour of White Orpingtons:—

Both sexes.—Beak: White.
Eyes.—Red.
Comb, face, ear-lobes, and wattles.—Red.
Shanks.—White.
Skin and flesh.—White.
Plumage.—Pure snow white, with a good lustre; free from any foreign colour.

Value of Points.

Head ...	10
Colour ...	30
Condition ...	15
Legs and feet ...	15
Size and type ...	30
	100

Colour of Jubilee Orpingtons:—

Both sexes.—Beak: White or horn colour.
Eyes.—Red or brown, the former preferred.
Comb, face, ear-lobes and wattles.—Red.
Shank and feet.—White or pinky-white; a little horn colour not to be considered as disqualification for the present.
Toe-nails.—White or horn.
Skin and flesh.—White.
Cock.—Plumage: N.B.—The term "mahogany" in this standard to be taken as meaning "bright mahogany, not dark nor maroon in shade."
Neck hackle.—Mahogany, with black stripe and white tip; the shaft mahogany, of same shade as feather.
Saddle hackle.—To match neck hackle.
Back.—To follow neck and saddle.
Breast.—Mahogany, with black spangle, and white tip; the three colours well broken and showing in equal proportions, avoiding a ticked effect on the one hand, and a blotchy effect on the other.
Wing bow.—To follow hackle.
Wing bar.—Black.
Secondaries.—Mahogany, black and white.
Flights.— ,, ,, but more white.
Sickles and true tail feathers.—White, or black and white, or mahogany black and white.
Coverts.—Black, edged with mahogany and white tips.
Thighs and fluff.—To follow breast.

Hen.—Head and neck: To match cock, allowing for difference of sex.
Body, breast, and back.—Mahogany, with black spangles and white tips; the shaft mahogony, of same shade as feather. The three colours well broken and showing in equal proportions, avoiding a ticked effect on one hand and a blotchy effect on the other; the effect to be uniform throughout the bird.
Wings.—As body, with flights as in cock.
Tail.—To follow the cock.
Thighs and fluff.—To follow the breast.

Value of Points.

Head	10
Colour	35
Condition	15
Legs and feet	10
Size and shape	30
	100

Colour of Spangled Orpingtons:—

Both sexes.—Beak: Black, or black and white.
Eyes.—Brown.
Comb, face, ear-lobes, and wattles.—Red.
Shanks and feet.—Black and white, mottled as evenly as possible; toe-nails, white.
Skin and flesh.—White.
The cock.—Neck hackles: Black, with white tips.
Saddle hackles.—Black, with white tips.
Back.—Black, slightly ticked with white.
Breast.—Black, with white tips; the two colours showing in equal proportions, avoiding a ticked effect on the one hand and a blotchy effect on the other.
Wing-bow.—Same as back.
Wing-bar.—Black.
Secondaries.—Black and white.
Flights.— ,, but more white.
Sickles. -Black with white tips.
Coverts.—Black with white tips.
True tail feathers.—Black and white.
Thighs and fluff.—Black, with white tips.
Hen.—Head and neck: Black with white tips.
Body, breast, and back.—Same as the breast of the cock; the effect to be uniform throughout the bird.
Wings.—As body, with flights as in cock.
Tail.—As in cock.
Thighs and fluff.—As in cock.

Value of Points.

Head	10
Colour	35
Condition	15
Legs and feet	10
Size and type	30
	100

Defects:—

Feathers on legs; long legs; poor shape; much white in lobes.

CHAPTER XXIII.

Orpingtons in Australia.

The first Orpingtons to reach Australia were brought out by a friend of the late W. Graham, of Five Dock, and arrived on 27th November, 1887, and were the first Orpingtons to appear at any

Australian show, namely Balmain, on the 4th July, 1889, Mr. Graham being the only exhibitor, their debut at a Sydney show being made a fortnight later, there being a solitary entry. In no other breed or variety of fowls that ever came to Australia was there such a continuous increase in the entries annually in metropolitan exhibitions, the single pair of 1889 being now regularly represented by between two and three hundred. These exhibits, it must be remembered, are from breeders who have, or think they have, the very best specimens of the breed; and when such a number of a breed appear at every show, it is evidence sufficient that Orpingtons are largely bred throughout the country, and indeed, was confirmation required of this, a visit to the poultry sale-yards any week would reveal the fact that the ordinary mongrel fowl, so long favoured in this as in most other countries, is giving place to pure breeds, Black and Buff Orpingtons holding chief places amongst the pure breeds which appear, followed by the Wyandottes. Nor does this exhaust the esteem in which the breed is held, for large numbers of the ordinary cross-bred market chickens claim an Orpington as one of their parents. Why this breed has become so universally popular can be best testified by my many correspondents on the subject. One prominent market poultry-man writes, "Plenty of eggs and a quick-growing carcase is what I required, and I gave up my favourite breed, the Plymouth Rock, for the simple reason that I found the Orpington the most profitable." Another breeder asserts that both Blacks and Buffs are the most profitable sorts he ever bred, and has handled Rocks, Wyandottes, and Langshans. A lady exhibitor says she has found the Blacks the most saleable of any fowls she has kept, and believes the Blacks are better than any of the other varieties. A country breeder mentions that the Black Orpingtons commence to lay before any of his other breeds, and also affirms as to their quick development. A number of other complimentary letters are before me, all exhaustive on the excellencies of the Orpington, and all conclusive that the breed is of all others the most popular, and is at the present time kept and bred on more agricultural farms than all the other breeds combined, Wyandottes excepted.

It has been already mentioned that the first to reach Australia came to this State, and it can be safely said that ever since the first arrival to Mr. Graham, and the second, by the ship "Macquarie" to Mr. J. E. Pemell, Sydney continues the headquarters of the breed, very large sums of money being received here from fanciers in other States each year for superior specimens for show purposes. Up to within a few years ago there was no official knowledge of the large numbers of this breed which each show season changed hands to Victorian breeders, but of late years, on account of poultry tick, a regulation by the Victorian Government demanding a clean certificate for each and every fowl that enters Victoria from New South Wales affords reliable statistics of the great quantities of Orpingtons from this State which each year appear at the Victorian Shows.

Further confirmation of Sydney being the great breeding centre for exhibition Orpingtons is confirmed by a report in *The Feathered and Kennel World* of a poultry show held in the Exhibition Building,

Melbourne, on 23rd June, wherein it is stated that in a class of twenty-six cockerels the first, second, third, and fourth prize birds were bred in New South Wales.

In all the other States and New Zealand Blacks and Buffs are most plentiful, sharing in popularity with the Wyandottes, but for numbers and quality this State is ahead, the classes at the Metropolitan shows for cockerels and pullets often reaching nearly fifty entries each; and that the Blacks will continue the most plentiful is generally acknowledged, the cause of their popularity being that they are considered for fancier and farmer alike the most profitable.

CHAPTER XXIV.

Orpingtons in America.

It is not surprising that Orpingtons became popular in Australia, seeing that they were made in England, where the overwhelming bulk of our prize poultry stock came from, and as the breed from its start had increasing admirers in England, we followed in the wake. It was, however, not a blind following, nor yet patriotism, seeing that the fowls actually possessed every attribute considered essential to a proper breed of fowls. These merits not only won them patronage here, but was actually a password of entry into every country in the world where domestic poultry are kept. For every specimen of the breed which came to Australia of late years, South Africa received hundreds; they are now plentiful in France, Italy, Germany, Denmark, and other Continental countries; while of the many millions of Russian eggs now sold annually in London, a fair proportion of them are laid by Orpington hens in Siberia. Coming to that country of big things—poultry farms included—it was thought by many that the breeders in the States would not take to the Orpingtons, first because they had not the yellow skin and legs which they so much desire, and second that it was not one of their own manufacture, as were the Rocks and Wyandottes. In my previous work on this breed six years ago extended reference was given to its prospects in the United States, the following extract sufficing for my present purpose:—"But whatever the prejudice in England in favour of white legs and skin, there cannot be a doubt about the American preference for yellow. Every one of the numerous and able poultry authorities of that country being strong advocates for bright yellow skin, whether for the roaster, the boiler, or the more youthful broiler; Brahmas, Cochins, Rocks, Wyandottes, and crosses from such being the varieties most largely bred for commercial purposes in that country. Consequently with this pronounced belief in bright yellow, it is not surprising that the Orpingtons found little favour in that great poultry-breeding country. However, when there is a good thing on the Yankees are soon found to be in it, and realising the increasing popularity of the Orpingtons in England during the past two or three years, several of the American fanciers have made very large purchases in England, the result being that many of the big American shows now make classes for this

breed." Other references and comparisons between the English Orpington and the American Plymouth Rock were made, but all to the disadvantage of the latter. In due course the work reached America, where it received criticism from the poultry press of that country. One leading journal, *Farm Poultry*, devoted two pages to the work, and while complimentary to a degree on the merits of the book, was most outspoken when a suggestion was made that Orpingtons would become plentiful in that country, and severe in the extreme when the writer had the effrontery to compare an English-made fowl with their much cherished Plymouth Rock. The following from the critique shows the American feeling in the matter, and later references confirmatory of the prediction, that despite local or other prejudices, a good breed of fowl of whatever name or colour will win favour with practical breeders, irrespective of clime or country. The editor says:—

"The 'Popular Orpington' is the title of a seventy-five page pamphlet by Geo. Bradshaw, Government Poultry Expert, just published by the Department of Agriculture, Sydney, New South Wales. It is a most exhaustive and readable pamphlet, devoted almost entirely to presenting the merits of this one breed, in its several varieties, to the farmers of Australia. Judged in the light of its purpose, the book is unquestionably one of the best publications of the past year. The subject is logically and skilfully treated, and but little matter is introduced that is not brought to bear well upon the points the author desires to make. I can easily imagine the Australian farmer overtaken by a worse fate than to have the conviction forced on him that it will pay him to breed Orpingtons. I can imagine, too, that were there no Plymouth Rocks or Wyandottes it might be worth while for someone in this country to devote himself to the task of persuading our farmers to use Orpingtons. As it is, the Orpington, if it is really a better fowl for the Australian farmer than the Plymouth Rock or Wyandotte is for the American farmer, is the best fowl there, for the same reason that it is not the best here, viz.—Because there yellow legs and skin are not specially prized, and here they increase the market value and economic importance of a breed. But when Mr. Bradshaw or any other admirer of the Orpington undertakes to show that it outclasses all the other breeds, he takes an untenable position. When he makes comparisons, quotes authorities, and gives facts and figures in support of his position, he challenges criticism; and when he expresses a very mean opinion of the Plymouth Rock as compared with the Orpington, or even the Wyandotte, which, in his judgment, is only a remote second to the Orpington, it seems to me he places himself in a position like that in which a certain well known judge of poultry once found himself.

* * * * * *

"As long as the Orpington enthusiasts content themselves with asserting that Orpingtons are good practical birds, having the same general characteristics as Plymouth Rocks and Wyandottes, and on some accounts more desirable than either for non-American markets, they are on safe ground. They are equally safe in saying that some

Orpingtons are better than some Plymouth Rocks, or some Wyandottes. But when they begin to talk about Orpingtons as a breed being better than the other breeds, they must back their talk by more substantial, direct proof than anyone has, to this date, seen fit to offer. And when they predict for Orpingtons greater and more permanent popularity than other breeds have attained, they simply make the wish father to the prediction.

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"If the outline history presented in 'The Popular Orpington,' of the rise and fall of various breeds in Australia, teaches anything, it teaches that fashions in breeds of poultry are more fickle there than elsewhere. The Australian breeder should learn from it that when one breed is at the height of popularity it is good policy to prepare, and prepare quickly, to fill the demand for its successor. If anyone there is at a loss to know what variety is coming next, he should communicate with some of our White Rock breeders. Considering the history of the varieties in Australia, and the recent history of the White Rock in America, that variety would seem the most likely one to 'take' next in Australia. In a previous pamphlet, 'Profitable Poultry Breeding for the Local and English Markets,' first issued in 1897, and now going through a second edition, Mr. Bradshaw's sole reference to the White Rocks is in this sentence: 'The ordinary blue Barred Plymouth Rock is too well known to be here described, and of late years a white has been produced, with little hope of a successful future.'

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"Clearly the author of 'The Popular Orpington' has no use for the Rocks. In the paragraphs devoted to them in the pamphlet from which the sentence just quoted is taken, he is unwilling to allow that they are really good all-round fowls; speaks of their 'reputed' laying properties, and attributes their decline in public favour to lack of merit. If the Rocks which reached Australia lacked merit to maintain popularity in competition with the Wyandottes, and later with the Orpingtons, they must have been very poor Rocks.

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"I would like to take Mr. Bradshaw out into the central west and show him the Barred Rocks on the farms where in State after State this is the popular variety. Nor is its popularity there of mushroom growth, or likely to prove transient. Throughout a quarter of a century it has gradually won its way into the confidence of the farmers as 'the business fowl of the nineteenth century.' It is to-day making headway more rapidly than ever, and the reputation of the Barred Rock has had much to do with the present phenomenal growth in popularity of the white variety, and the less general, but still marked rate of growth of the newer Buffs.

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"Mr. Bradshaw devotes a chapter to 'Orpingtons in America.' Considering the American preference for yellow-legged, yellow-skinned poultry, he thinks it 'not surprising that the Orpingtons

found little favour in that great poultry breeding country.' However, he adds, 'when there is a good thing on, the Yankees are soon found to be in it, and realising the increasing popularity of the Orpingtons in England during the past two or three years, several of the American fanciers have made very large purchases in England, the result being that many of the big American shows now make classes for this variety.' Then he quotes letters from two American breeders, intimating that the popularity of the Orpington in America is assured, and closes by calling attention to records of shipments of Orpingtons to this country which appear from time to time in Mr. Cook's personal poultry journal.

"The Orpingtons should have an increasing number of admirers in this country, but that any variety of Orpingtons should ever become as popular as the Plymouth Rock is a stretch of imagination, and but father to the thought."

A great deal more was said by the American editor on behalf of the American breeds, and while not depreciatory of the Orpingtons, the whole tone of the article was to the effect that the English-made fowls would not make much headway in America. Whether such predictions or those of the writer's were the correct ones will be seen from the following, the facts being that the Orpington fowl from that time has been increasing in the States and to an extent far beyond any anticipations, so much so that two or three years ago a special monthly poultry paper was issued in its interests and entitled *The Orpington Fowl*. England, the birthplace of the breed, not being equal to that occasion yet. Thousands of pounds worth of stock were imported annually from England, the demand for the breed being such, that the late W. Cook established a large farm at Scotch Plains, New Jersey, for the special purpose of breeding these fowls for American purchasers, the latest report being that there are over 3,000 of young stock of this breed for sale. Clubs have been established for the encouragement of the several varieties, the last one being devoted to Buffs, and, as showing the progress made, within five months after its inception over 100 members were enrolled. The secretary lately wrote: "We cannot recall any poultry club which has made such progress in so short a time, there being hardly a State or Territory in the Union which is not represented in the membership."

It now remains to give the American opinions of the English breed, as written by some of its patrons in that country. Mr. Irving Crocker, a well-known breeder, contributes the following:—

"Although I have bred the Orpington fowl for two or three years only, I have been able to visit those who have bred them for a much longer time, and by asking questions kept myself pretty well posted since their first introduction into this country. From my own acquaintance with the breed, I can say that its good qualities have never been exaggerated. This was something of a surprise to me, for I always made some allowance for what I supposed to be the lively imagination of too enthusiastic admirers. But I have to confess, in the light of my own experience, that in doing so I did both the breeders and the breed an injustice.

"Right here let me say that in thoroughbred poultry I could never be satisfied with symmetrical proportions or perfect markings alone, much as I can admire them. I must have a breed that can be depended upon to fill the egg-basket, while the culls make fair returns as market poultry. This may be commercialism, but it is also business. I have never owned a breed that combined all of these traits to the same extent as does the Orpington, and I have experimented not a little. For beauty of outline they are certainly unsurpassed, while their rapid growth and early maturity is remarkable, to say the least. Added to these qualities, they are possessed of extreme hardiness. I do not recall ever losing but one from sickness, and that one was quite a young chick. Out of nearly 100 White Orpingtons hatched last spring, not one has ever shown the slightest symptom of disease. Some may say this was owing to the treatment they received. While that may be true to some extent, other breeds in the past, under the same conditions, were not exempt from colds, catarrh, roup, canker, bowel trouble, and other ills to which poultry flesh is heir. This being the case, I am forced to the conclusion that the Orpington has an especially strong and rugged constitution. I believe there are just two objections that are urged against this breed. The one most commonly heard is, they have white shanks. Now, this would be an objection worth considering if yellow shanks were an indication of any peculiar merit belonging to the breeds having them. So far from this being the case, we have but to compare some of the yellow-legged breeds to see that particular colour carries nothing with it but mere fancy. For example, we have the Indian Game, which is a good table fowl, but a poor layer. Then we have the Leghorn, which is a good layer, but worthless for the table. Added to these, we have others, breeds and no breeds, big and coarse, but of no particular account anyway, yet all with yellow legs. So this objection simmers down to a matter of preference, a question of taste, and educational prejudice. But there is something to be said for the white-skinned breeds as such. In the first place, they are exceptionally good layers. In the second place, this white skin carries with it a whiter, more tender, juicy, and delicate meat than can be found on any yellow-skinned fowl. So marked are these qualities that, in sections where the Orpingtons are grown, largely to the exclusion of other breeds, retail dealers in dressed poultry have a large and persistent demand for these fowls because of the qualities mentioned.

"I believe the time will come when the American breeders, becoming accustomed to these white shanks and more thoroughly understanding the superior merit accompanying them, will discard the prejudice that in some cases influences them, and admit that the white shanks are not so bad after all.

"Objection number two is 'it is an English breed.' I hesitate to mention thiscriticism because of its in significance. The mere allusion is to give it undue importance. My only apology is that it has already been harped upon in the poultry papers. The class of would-be fanciers who offer this objection seem to be thoroughly tinctured with a bogus Americanism. They can see no good in any breed of

foreign origin, and the favourable mention of an English breed drives them into a perfect frenzy of supposed patriotism, while they shriek 'Anglo-maniacs.' My advice to all such self-sufficient persons is to withhold their criticism of English breeds because they are English until they have produced one equally good."

Mr. Wallace P. Willett, of New Jersey, one of the first American Orpington breeders, says: "The surprise to me is that this wonderful breed, which has made its own way on its merits over all the rest of the world, has been kept in the background so long in these United States. There is not a country in Europe, Asia, Africa, or Australia where this breed has not taken the lead of all others, and it has only been brought out five or six years. Now that the United States is fully ripe and ready and on the look-out for a new sensation in the poultry world, it is bound to come, and is coming in the 'Orpingtons,' and particularly in the Buff Orpington, although my personal regard is equally good for the Blacks. The 'Orpington' Club in this country will no doubt follow the lines laid down by the English Orpington Club, and adopt the standard of perfection as published by them. In my opinion, from three years' experience with the Orpingtons, the Orpington Club will have a simple walk over in pushing their favourites. In fact, the breed will push itself here as it has everywhere else, and become ere long the poultry craze."

Another breeder writes: "To-day the Orpingtons are the most popular breed in England, and are sure to win favour in the United States. They combine the weight of the Cochin with the laying qualities of the Leghorn. What better fowl can anyone wish? They have strong, rather short, white legs, free from feathers, and white skin. Some breeders object to the white legs and skin, but I find that some broiler plants are bleaching the yellow skin of Rocks, as consumers desire white. With Orpingtons there is no need of bleaching. The rich flesh colour showing through the skin gives them a fine appearance when dressed. The shape of the Orpington is long, broad, and deep; breast broad, deep, and full, much better breasted than the Rocks, broader and more plump, as they are a larger bird. They are active, but contented and easily yarded. Chicks are very hardy, maturing early, and have been known to commence laying at the age of four months."

The opinion of an American poultry judge, Mr. E. S. Comings, will complete these references, all going to show, as previously stated, that the Orpington fowl is not only a popular one, but is universally so. "Any new breed when first coming into public notice must submit to severe criticism, and if its merit is sufficient to withstand this it means much to the breeder and fancier of the breed. That the Buff Orpington is one whose claim must be recognised no judge of fowls can question, so when I say that in this new candidate we have one worthy of our attention it is because I believe it. The popular ideas among American breeders in favour of the yellow leg and yellow skin is against them. Yet when dressed the Buff Orpington must present an inviting appearance, for their good size and plump bodies are surely in their favour. Many times they have been compared to the Buff

Plymouth Rock, many saying that there is not enough difference between these varieties to keep them apart, but if you will study them carefully you must admit that they are two distinct varieties, and of the two the better specimens of the Buff Orpington are to-day far ahead of the Buff Rock in finished appearance. Note the curved lines in the outline of the Orpington, note how nicely he stands in equal balance, see how symmetrical each line as it merges into these curves that always please the fancier. Note that beautiful transparent buff outer colour—and it seems a buff peculiarly its own. Combs are nicely balanced in the better specimens and seem far more symmetrical than those of the Buff Rock, and every breeder knows how hard it is to breed a symmetrical comb on any variety of the Rock family. Any novice can see that in the Orpington we have a variety that can be made either a fancier's or a commercial fowl. In this variety, as in all buffs, there are several things to avoid in mating to produce exhibition specimens, namely: White in hackle, white in wings and flights, black in wings or tail. Of the two colour evils choose the latter, as black represents a colour quality, and it is but a step from black to rich chestnut, and from chestnut to buff; while white will never breed out, and Nature's rule of reverting to parent stock will annoy you for many seasons. The Buff Orpington has come to stay. Let us give it a cordial reception. That it is already claiming the attention of some of our leading fanciers the show room this coming season will have many fine specimens to prove, and we can offer no better wish than that in numbers and quality they may stand side by side the older varieties. Chicago, the Madison Square of the West, invites the fanciers of the Orpington to be well represented in the next exhibition. This will increase the admiration of this variety, placing them side by side those already recognised."

In concluding the rise and progress of this comparatively new breed in the States, and confirmatory of the writer's prediction of a few years ago, it may be mentioned that at the World's Fair held at St. Louis last year over 300 Orpingtons were exhibited, 152 of these being Buff, a much larger display than ever made at any Australian show, and exceeded by very few in England. That they will ever approach the Plymouth Rocks in the State is not even remotely suggested, but the already large army of patrons bids fair for the future prospects of the breed. The concluding sentences on the breed by an American poultry journal at the St. Louis fair was that it was a great day for the Orpingtons, and from all written and said about them above there is every reasonable hope of America becoming a great country of Orpingtons.

(*To be continued.*)

Hawkesbury Agricultural College and Experimental Farm.

Experiments with Turnips and Swedes.

G. MARKS,
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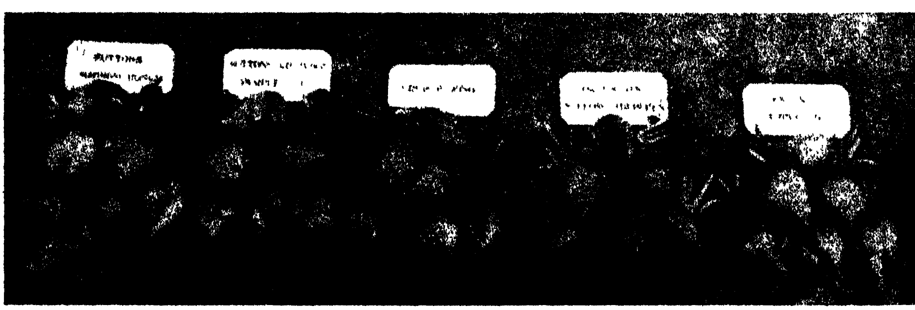
Variety Trials.

THIS experiment was carried out in plot B6. The land consists of a light pipe-clay loam, and was cropped previously with oats, which were cut for hay. It was ploughed about the middle of January, and three weeks later a dressing of slacked lime was applied, at the rate of a ton to the acre being used, and harrowed in. In March it was reploughed, and well worked for sowing. The seed was sown with the Farmer's Friend seed drill, in drills 2 ft. 6 in. apart, and manured at the same time with a mixture of superphosphate 1 cwt., dried blood 1 cwt., and sulphate of potash ½ cwt. per acre.



1 2 3 4 5

1. Sutton's Magnum Bonum; 2. Champion Purple Top; 3. Crimson King; 4. Green Top Yellow Aberdeen; 5. Skirving's Purple Top.

The land was in splendid condition, due to favourable weather, and, as a result, the whole of the varieties planted germinated well. When about 6 inches high, the plants were thinned out to a distance of 10 inches or 12 inches apart. The soil was kept clean and well loosened by frequent use of the hoe and Planet Jr. cultivator. When the turnips were about half-grown, the leaves covered the ground, and all weed growth was completely arrested.

The varieties Champion Purple Top, Crimson King, and Magnum Bonum were obtained from the well-known firm of Sutton's, in England, and forwarded by the Seed Branch of the Department of Agriculture. The others were obtained from Messrs. Anderson & Co., of Sydney.

Five drills 5 chains long were sown of each variety, and portion of a drill a chain in length was taken from each variety for estimating the yield. Several of the varieties produced a large amount of leaf growth, and as this is greatly relished by sheep, goats, and pigs, its weight was also ascertained. It will be noticed, on referring to the tables, that two weighings of each were obtained. The first was made when the varieties appeared to have their maximum amount of top growth, and the second when the roots were fully developed. In the latter case, the leaves had diminished considerably in number and weight, consequently their yields were not obtained.

The following table gives the names of the varieties, with their respective yields :—

First Weighing from Plot.

Name of Variety.	Roots.											Tops.					
	Date Sown.	Date Harvested.	Length of Drill.	Weight.			Yield per Acre.					Weight of Green Top.		Yield per Acre.			
	1905.	1905.	ch.	c.	q.	lb.	t.	c.	qr.	lb.		qr.	lb.	t.	c.	qr.	lb.
Sutton's Magnum Bonum	9 Mar.	6 July	1	0	3	0	9	18	0	0		1	0	3	6	0	0
Champion Purple Top ...	9 ,,	6 ,,	1	0	3	0	9	18	0	0		1	14	4	19	0	0
Crimson King	9 ,,	6 ,,	1	0	3	2	10	2	2	24		1	6	4	0	0	16
Green Top Yellow Aberdeen.	9 ,,	6 ,,	1	0	3	16	11	15	2	24		2	19	8	16	3	4
Skirving's Purple Top ...	9 ,,	6 ,,	1	0	2	22	9	3	3	12		1	23	6	0	0	24
Purple Top Yellow Aberdeen.	9 ,,	6 ,,	1	0	2	6	7	6	0	16		2	12	8	0	1	4
Emperor Green Top ...	9 ,,	6 ,,	1	0	2	6	7	6	0	16		2	7	7	8	2	0
East Lothian Purple Top	9 ,,	6 ,,	1	0	3	0	9	18	0	0		0	26	3	1	1	4
White Pomeranium ...	9 ,,	6 ,,	1	1	0	4	13	13	1	20		3	0	9	18	0	0
Anderson's Purple Top...	9 ,,	6 ,,	1	0	2	21	9	1	2	0		1	19	5	10	3	4

Second Weighing from Plot.

Name of Variety.	Roots.									
	Date Sown.	Date Harvested.	Length of Drill.	Weight.			Yield per Acre.			
	1905.	1905.	ch.	c.	qr.	lb.	t.	c.	qr.	lb.
Sutton's Magnum Bonum	9 Mar.	14 Aug.	1	1	1	16	18	7	2	24
Champion Purple Top	9 ,,	14 ,,	1	1	0	20	15	11	0	16
Crimson King	9 ,,	14 ,,	1	1	0	22	15	15	3	12
Green Top Yellow Aberdeen ...	9 ,,	14 ,,	1	1	0	24	16	0	2	8
Skirving's Purple Top	9 ,,	14 ,,	1	1	0	12	14	12	1	4
Purple Top Yellow Aberdeen ...	9 ,,	14 ,,	1	1	0	11	14	9	3	20
Emperor Green Top	9 ,,	14 ,,	1	1	0	8	14	2	3	12
East Lothian Purple Top	9 ,,	14 ,,	1	1	0	26	16	5	1	4
White Pomeranium	9 ,,	14 ,,	1	1	1	23	19	4	0	24
Anderson's Purple Top	9 ,,	14 ,,	1	0	3	25	12	16	3	20

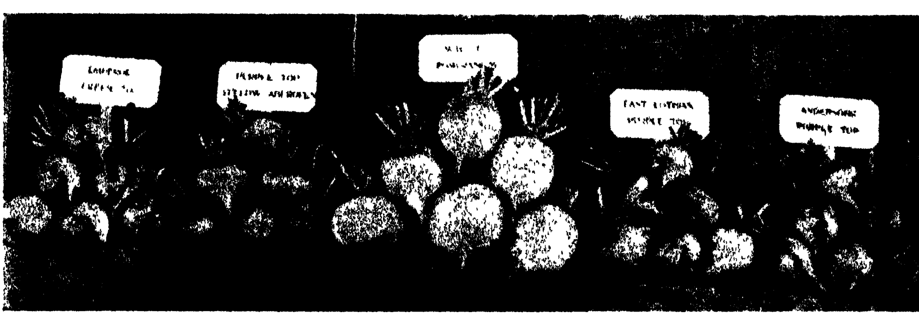
Six of the best average roots were also taken and weighed together, and the best of each also weighed separately, the following being the results :—

Variety.	Weight of Single Root.	Weight of Six Roots.
	lb.	lb.
Sutton's Magnum Bonum	5¼	27¾
Champion Purple Top	4	23
Crimson King	4½	22½
Green Top Yellow Aberdeen	4½	25
Skirving's Purple Top	4½	24½
Purple Top Yellow Aberdeen	5	26
Emperor Green Top	4¾	24½
East Lothian Purple Top	6½	27
White Pomeranium	12	54½
Anderson's Purple Top	4	23

The rainfall for the time during which the experiment occupied the ground was 11·8 inches, made up as follows :—

March...	3·54 inches.
April	3·95 „
May	3·38 „
June	·64 „
July	·19 „
August	·11 „
	11·81 inches.

94 points were received during the last three months. In addition to the small amount of rain obtained, the land was dried up considerably by heavy frosts and dry westerly winds, which seriously interfered with the proper development of the roots.



1 2 3 4 5

1. Emperor Green Top; 2. Purple Top Yellow Aberdeen; 3. White Pomeranium; 4. East Lothian Purple Top; 5. Anderson's Purple Top.

The accompanying photographs were taken of the six single roots weighed, and will convey some idea of their size.

The Pomeranium produced the largest roots, and gave the heaviest returns, but the roots were not so solid as the other varieties. It also produced the greatest amount of green top. Sutton's Magnum Bonum came second, and the whole of the roots were firm, and suitable for marketable purposes. This variety would appear to be the best for general use.

Cultivation Trials.

This experiment was carried out in plot A7. The soil was of a similar nature to that of B6, and was previously cropped with Medeah wheat, which was harvested for grain. The stubble was ploughed under in December, 1904. It was reploughed in latter end of February, 1905, and sown on 10th March. The object of this experiment was to determine :—

The effect of planting different distances apart on the level.
The effect of sowing on ridges different distances apart; and
Broadcasting.

Anderson's Purple Top was the variety selected for this experiment. Prior to sowing, manure at the rate of 2½ cwt. per acre was applied, made up as follows :—Dried blood 1 cwt., superphospate 1 cwt., sulphate of potash ½ cwt. As in the other experiments, five drills were planted for each plot, and in broadcasting, two strips of 12½ feet were lightly harrowed in after sowing.

The following table shows the results :—

First Weighing from Plot.

How Planted.	Date Planted.	Date Harvested.	Length of Drill.	Weight.			Yield per acre.			
	1905.	1905.		cwt.	qr.	lb.	Tons	cwt.	qr.	lb.
Drills 2 ft. apart on flat	10 Mar.	July ...	1 chain	0	3	3	12	16	1	10
Drills 2 ft. 6 in. apart on flat .	10 ,,	,, ...	,,	0	3	20	12	5	0	16
Drills 3 ft. apart on flat	10 ,,	,, ...	,,	1	0	0	11	0	0	0
Broadcasted	....	.. ..	......	......			... .			
Drills 2 ft. apart on ridges	10 Mar.	July ..	1 chain	0	2	27	12	4	2	6
Drills 2 ft. 6 in. apart on ridges ...	10 ,,	,, ...	,,	0	3	2	10	2	2	24
Drills 3 ft. apart on ridges	10 ,,	,, ..	,,	0	3	16	9	16	1	20

Second Weighing from Plot.

How Planted.	Date Harvested.	Length of Drill.	Weight.			Yield per acre.			
	1905.		cwt.	qr.	lb.	Tons	cwt.	qr.	lb.
Drills 2 ft. apart on flat	14 Aug....	1 chain	0	2	23	11	12	3	2
Drills 2 ft. 6 in. apart on flat ...	14 ,, ..	,,	0	3	8	10	16	3	12
Drills 3 ft. apart on flat	14 ,, ...	,,	1	0	2	11	3	3	20
Broadcasted	....	......	....			....			
Drills 2 ft. apart on ridges	14 Aug....	1 chain	0	2	18	10	18	0	4
Drills 2 ft. 6 in. apart on ridges ...	14 ,, ...	,,	0	2	20	8	19	0	16
Drills 3 ft. apart on ridges	14 ,, ...	,,	0	3	10	9	4	2	16

The ridges were made with a ridging plough, about 6 inches high, and the seed sown along the tops of these with the drill. The plants were thinned out the same as in the variety trial, and, with the exception of

the plots broadcasted, the soil was kept clean and loose by the use of the hoe and cultivator. In this experiment only the marketable roots were weighed. With both broadcasted plots the plants did not form roots of any size, and no weights were taken. This was evidently due to the dry weather, and our being unable to loosen the soil with the cultivator. It will be noticed that the heaviest yields were obtained from the drills planted 2 feet apart, and also from those grown on the flat.

These results seem to indicate that for heaviest yield per acre the 2 feet drills are slightly in favour, but for the size of individual roots the 3 feet drills are to be recommended. The results are greatly affected by the weather, since it would appear that the leaves of the Swedes in the 2 feet drills covered the ground more completely than in the 3 feet drills, whereby less evaporation from the soil took place when subjected to the dry westerly winds which prevailed during this experiment.

The effect of evaporation was most pronounced in the drills planted on ridges, as the soil was much drier when the roots were pulled than where they were grown on the flat, and the yields obtained were also considerably lower throughout. This shows that, when growing turnips and Swedes under dry conditions, best results will be invariably obtained when they are planted on the flat, in land deeply worked and well cultivated.

Value as a Stock Food.

The following may be taken as the average composition of a Swede root :—

Water	88·6
Ash	1·2
Protein	1·2
Fibre	1·3
Carbo-hydrates or Nitrogen Free Extract ...	7·5
Fat	·2
	100·0 parts.

Although the percentage of water appears high, it must be remembered that the dry matter is practically all digestible. This cannot be said of a number of stock foods usually used. Succulence, bulk, palatableness, digestibility of the dry matter, and the high percentage of sugar it contains, give turnips a peculiar value as a food. Sheep and goats fatten readily when fed on them alone, and they are also valuable for pigs and cattle, coming in at a time when other foods are often scarce. They should be fed to dry stock on the dairy farm in preference to milch cows, as if given to the latter the milk will be tainted. The turnip possesses good keeping qualities, and may be either stored or left in the field for a couple of months till required. If left for any considerable length of time, the proportion of woody matter increases, rendering the root unpalatable and less easily digested. Sheep may be utilised for feeding

off a crop, and when confined to limited areas by means of portable fences, very little will be wasted. The manure left also enriches the land for the succeeding crop.

Cost of Production.

The ultimate success of a crop depends very largely on the preparation and cultivation of the soil, and too much attention cannot be bestowed on these operations,—the cost being the same, whether an average or heavy yield is obtained.

The following may be taken as the average cost of raising an acre of turnips, yielding 14 tons, for market:—

	£	s.	d.
First ploughing	0	10	0
Second ploughing	0	9	0
Harrowing, three times, @ 1s.	0	3	0
Rolling, twice, @ 9d....	0	1	6
Manure...	0	15	0
Sowing	0	1	9
Seed, 2 lb., @ 1s.	0	2	0
Thinning	0	10	0
Cultivating, six times, @ 1s. 6d.	0	9	0
Pulling and bagging, 5s. per ton	3	10	0
Bags (second hand) 15 dozen, @ 3s. 6d. ...	2	12	6
Loading and carting 1 mile	0	14	0
	9	17	9
14 tons, at £2...	28	0	0
Profit	£18	2	3

£2 per ton may be taken as a fair average price, considering one season with another.

Summary.

While carefully avoiding any attempt to draw hard-and-fast conclusions from the result of one season's experiment, it is interesting to note that there are great differences in the cropping power of the varieties, grown as they were, side by side, and under the same conditions. The experience one gains in personally conducting the various parts of an experiment such as this, strengthens the conviction that it is well worth every farmer's while to test several varieties for the purpose of finding out those best suited to his land. This part of the experiment is so simple and easy of accomplishment, and the results to which it might lead so valuable, that no one should hesitate to carry it out. The scales should be freely used. The differences which it frequently reveals are so great and unexpected, that estimate of yield by mere inspection should not be accepted as sufficiently reliable. With the aid of the weighing machine farmers may, by the ordinary means of observation, safely enough judge of the relative values of the different varieties.

Seeds and Seed Testing.

(For Farmers.)

[Continued from page 1069.]

C. T. MUSSON,
Hawkesbury Agricultural College.

Part III.

How to obtain good Seed.

The following points require special attention :—

1. Buy from reliable seedsmen on tested sample, or obtain samples and get them tested—this means buying to sample. Some firms will give percentage statement as to vitality and purity; this is valuable even without guarantee.
2. Avoid cheap seed. Seed firms will give good reliable seed for good prices.
3. Ask for a statement of quality. If this is regularly carried out, seedsmen will be obliged to provide it, and thus put before customers details as to the germination capacity of the seeds they sell.
4. Never fail to carry out home tests in order to keep in touch with the matter, and prove all seed used.

Purchasing Seed.

It must be clearly understood that seedsmen have advised in the past, and do at present, the use of good seed; they prefer selling seed that can be recommended as good, but they can hardly be expected to guarantee the crop. Seeds may fail to germinate from a variety of causes, even though exposed to all necessary favourable conditions; this may be owing to faults in the seed, or to circumstances over which the seedsman has no control.

A buyer has, however, a very reasonable claim in wanting to know what he is buying, in respect to two points :—

1. How much of what he is buying is real seed, true to name ?
2. What proportion is likely to germinate ?

Prominent seedsmen insert in their catalogue some sort of non-warranty clause. As follows is one taken from a leading Sydney catalogue for 1905 :—" We recognise the great responsibility that devolves upon us to supply our customers with the best seeds obtainable, and while we are proud of the confidence reposed in us for so many years, it must be clearly understood that we give no guarantee as to the correctness of name, description, or product of the seeds we sell, and any purchaser who does not accept our seeds on these conditions is at liberty to return them at our cost, within seven days from date of purchase. Our business system is as perfect as we can make it, but still we are not infallible.

The best guarantee our customers can have is the fact that our large business has been built up by selling good seeds, and it would very soon be ruined *if we sold inferior stock.*"

It should be remarked that in Europe many Experiment stations hold control contracts with seed merchants for testing purposes, and a certificate of test is then put before buyers along with the samples of seed for sale.

Dealers are themselves often ignorant of the quality of the seed they offer. A demand by the buyer for information as to the article would cause seedsmen to be prepared with particulars as to purity and vitality percentages, which would be all a buyer needs to enable him to judge the article correctly.

Adulteration is not practised here so far as is known to the writer, meaning by the term a substitution of cheaper seed in part for that of a more valuable kind.

Making up for Market.

Beyond the suitable preparation required in order to render seed fit for use, by the elimination of all useless matter, so far as is possible, there may be cases where seed is "prepared" by being "dressed" to show a good appearance. This, too, may be passed over as practically non-existent here. It is well, however, to pay attention to the matter of "get up" in seeds; any exceptional appearance should make us suspicious.

Exposure of Seeds for Sale.

Seeds exposed to sunlight are liable to lose in germinating capacity even to a large extent. If seeds are open to the air whilst awaiting sale numerous insects, and possibly fungus parasites, which are always round about, will commonly seize hold of the opportunity to settle therein. Seeds should, therefore, not be left exposed, but should be carefully protected from possible attack, and from too free an exposure to light and air. It would be well for buyers to avoid purchasing from such stock, where there is any danger from weevils or other stored seed pest.

Beware of highly-coloured Advertisements.

One very interesting point for purchasers to consider is in relation to marvellous forage and other plants advertised in highly coloured language by enterprising firms. It is safe to beware of all such extravagant promises as one sees in certain catalogues, chiefly foreign. These wonderful things, it is safe to say, find no place in the catalogues of our leading seedsmen; no reputable firm would lend itself to what is, in plain terms, nothing but deception—fraud it is sometimes called.

Two examples are called to mind in relation to this subject. Some two years ago there appeared extravagant and laudatory notices as to the value of a new and hardy fodder plant, called "World's Wonder Forage Plant"; "Pencilare," Mand's Wonder Forage Plant; and the

like, emanating from the States. This article was soon brought to our notice, laudatory accounts of it being published in many papers throughout Australia. Finally it was run down as being merely the well-known Pearl Millet, revived and boomed under another name. "Billion Dollar Grass (Prairie)" is another such case. Yet another is that of the "Italian Consolidated Grass," brought under our notice by a resident of this State as a great fodder producer; it turned out to be Prickly Comfrey, which was boomed here many years ago as likely to revolutionise the sheep-growing industry of Australia, and has long since passed into oblivion.

These examples, though many similar cases might be mentioned, are sufficient to show that purchasers would do well to let alone any plants that are being advertised in highly coloured and glowing language, or at least submit a question in relation to the matter to some competent authority before purchasing.

A consideration of this subject only emphasises the importance of extreme care, not only in the matter of quality in seed, but in relation to the introduction of undesirable varieties. There is absolutely no need for a purchaser to pay fancy prices for useless or common seed, boomed under a fancy name, and offered at extravagant prices. High prices are not always proof of the article being good, or even desirable.

Buyers should ask for Samples.

Buyers having decided upon their requirements might very reasonably, in writing to seedsmen, ask for samples of seed, and for a statement as to what vitality and purity the seed may be expected to give. If this were done, the purchaser would know his position clearly; he could afterwards, if he wished, proceed to test the seeds for himself. An answer to the above question would, however, give the real quality of the seed on the points mentioned.

The Law as it Relates to Seed Selling.

The time has arrived when the question of an Act for regulating the selling of seed in this State is within the range of practical politics.

It may be remarked that clause 43 of the Report of the Departmental Committee appointed by the Board of Agriculture, England, to inquire into the "Conditions under which Agricultural Seeds are at present sold," stated :—" The Committee cannot endorse the view of some persons that no seed should be permitted by law to be sold unless of a certain minimum purity and germinating quality, for three reasons :—

" 1st. The difficulty of fixing such a minimum;

" 2nd. The temptation to seed merchants who now sell a high quality of seed to bring down their stock to the level of the minimum required by law;

" 3rd. Because they are adverse to placing restrictions on any trade in regard to the sale of an article of any quality, provided the customer is made aware of that quality when purchasing.

"It would appear, however, that there is room for an Act enforcing upon vendors the necessity for declaring the quality of all bulk seeds for sale, as regards purity and vitality."

The subject is receiving increased attention in most agricultural countries. In some places, testing before sale is compulsory for all lots over a given weight --22 lb., for instance, in Hungary. In such cases regulations are laid down as to procedure, and the certificate must give name of seller, name of variety, percentage of purity and germination, and origin of the seed. Precise figures must be stated.

Acts regulating the sale of seed are in force in several other parts of the world. Such an Act here should, it is considered, provide for the vendor giving with each lot of agricultural seed sold over 1 lb. weight, a certificate guaranteeing the quality of the seed, in respect of vitality and purity.

An Act for this purpose might be drafted somewhat as follows (on the lines of an Act in operation in Maine, U.S.A.) :—

AN ACT TO REGULATE THE SALE OF AGRICULTURAL SEEDS.

Every lot of seeds of agricultural plants, containing one pound or more, sold, offered, or exposed for sale, *for seed*, shall be accompanied by a written or printed guarantee of its percentages of vitality and purity (freedom from foreign matter), provided that mixtures may be sold when the percentages of the various constituents are stated.

Dealers may base their guarantees upon tests conducted by themselves, their agents, or by authorised persons appointed by the Under Secretary for Agriculture, provided that such shall be made under such conditions as the said Under Secretary may prescribe.

The said Under Secretary for Agriculture shall publish the conditions under which tests are to be made, with equitable standards of vitality and purity, and such other information concerning agricultural seeds as may be of public benefit.

Any person or persons who shall sell, offer, or expose for sale, agricultural seeds without complying with the requirements of sections 1 and 2 of this Act, shall, on conviction in a court of competent jurisdiction, be fined, not to exceed for the first offence, and not to exceed for each subsequent offence.

Any person or persons who shall, with intention to deceive, wrongly mark or label any package or bag, containing seeds of agricultural plants, shall be guilty of a misdemeanour, and upon conviction in a court of competent jurisdiction shall be fined, not to exceed for the first offence, and not to exceed for each subsequent offence.

For the purpose of this Act, agricultural seeds and plants shall mean cereals, grasses, forage plants, vegetable and garden plants, but not including those of trees, shrubs, or ornamental plants, nor cereals and other seeds to be used as food.

The Under Secretary for Agriculture, on becoming cognisant of the violation of any of the provisions in this Act, shall prosecute the party or parties so guilty.

This Act shall take effect

Seeds sent to the H. A. College will be Tested and Reported on.

The Principal is prepared to receive seed samples for examination as to purity, genuineness, germination capacity and energy, weight, and actual value. Official reports will be issued on completion of the examination giving detailed results.

Directions for preparing sample.

Persons sending samples of seeds for examination should observe the following precautions :—

Size of sample.—If a complete report is required, size of sample should be—

Clovers, Tobacco, and other small seeds	2 oz.
Buckwheat, Millet, Rape, Cabbage, and other medium-sized seeds	4 oz.
Cereals, Pulse (Peas, Beans, Lentils, &c.), Sunflower, Beet balls, and other large seeds	8 oz.

If there is much impurity, double this quantity should be sent.

If only a germination test is required, quantities should be not less than 400 of all small and medium seeds, nor 200 of large seeds.

Drawing the sample.—To ensure average samples being sent they should be taken from various parts of the bulk, well mixed, and sent in dry receptacles. It should be noted that weed seeds being small are apt to work to the bottom of the bulk seed.

If to be tested for water, the seed should be sent in sealed glass bottles.

Details required.—1. Name and address of sender—and wherever practicable—2. Name of variety; 3. District where grown; 4. Year of harvest.

The investigation is made to determine—

1. Genuineness of species.
2. Purity, in per cent., with determination of the impurities, such as chaff, sand, other seeds, and weeds.
3. Average weight of the seed, as to whether heavy or light.
4. Germination capacity and energy.
5. Utility value.

Time required for test.—For complete examination, one month. A preliminary report will be sent within 7 days, if specially required.

Germination tests reported on in from 14 to 21 days after receipt of sample, except in cases of refactory seeds.

Examples of Reports as issued are appended.

HAWKESBURY AGRICULTURAL COLLEGE—BOTANICAL LABORATORY.

Report on Seed submitted by ....

Name.	Composition of Sample.			Per cent. Pure Seed.	Size.	Weight.	Standard Weight.	Germinating Capabilities of 100 Pure Seeds.					Germinating Standard.	Real Value.	Remarks.
	Seed as named.	Other Seed.	Refuse.					Germinating Energy		Germinating Capabilities.		Non-Germinating.			
								In days	Per cent.	In days	Per cent.				
Example 1.															
American Lucerne.	99 per cent.	1 per cent. weeds	....	99	Average.	About 220,000 to the lb.	About average.	4	70	7	76·7	23·3	85	76·2 Purity × germination, ÷ 100	A fair sample. Quite as good for germination capabilities as we are accustomed to test. The weeds include— a Fat Hen (Chenopodium). Rib-grass (Plantago lanceolata) Sheep Sorrel (Rumex acetosella). a Mallow. 2 Umbelliferous plants near wild Parsley. 2 Composites. a Clover (Trifolium). a Mustard (Brassica). Undesirable immigrants.
The weed seeds form, approximately, 1 per cent. by weight. Every 1 lb. of Lucerne would contain 3,314 weed seeds.															
Example 2.															
Wheat from the Argentine; name unknown. It is a small-grained variety red.	87·289 An impure sample. Margin of deviation should not be more than 2 per cent.	5·1,394	·722 Broken seed, 6·848	87·289	Very small. 17,120 seeds to 1 pint. Of good, plump seed; there should be about 9,500 to 10,000.	62½ lb. per bushel. 1,000 seeds weigh 407 grains.	60 to 64 lb. 1,000 good, plump seeds should weigh 780 grains approx.	5	92 Good	5	92 Medium. Margin of deviation should not be more than 5 per cent.	8	98 in 100 good seeds	As live seed. 80·30 per cent. against a standard of 98 with a 6 per cent. margin of deviation. If 4s. is price paid, cost of the good live seed, is about 5s. 7$\frac{7}{11}$d., apart from cost of cleaning.	Seed small. 1 bushel contains— 51¼ lb. good seed. 4¼ „ broken seed. 3½ „ weed „ ½ „ rubbish. Total impurities, about 8 lb. in a bushel. The Weed Seeds are— Corn Cockle (Githago segetum), mainly—with a few—Darnel (Lolium temulentum) and Barley. 1 bushel contains, approximately, 43¾ lb. germinable seed. Items in size and weight are given for purposes of comparison. This sample chiefly remarkable for large quantity of weed seed.

Special Note in relation to Corn Cockle in Wheat.

(Attached to Example 2).

V. K. Chesnut writes, in "Thirty Poisonous Plants of U.S.A." (1898), of the above plant:—

"The *seed is poisonous*, the poisonous property being found in nearly all parts of the plant, but mainly in the seed. The cases of poisoning are generally produced by a poor grade of flour made from wheat containing cockle seeds. It is difficult to get the seed out of the wheat bulk. Flour containing certain amounts of cockle seed ground up has been made into bread and eaten with fatal results (the amount of cockle seed, however, being large), the baking not always being sufficient to decompose the poison. Chronic cases of the disease are known as "Githagism." Corn-cockle meal is easily detected in second and third class flour by the presence of the black roughened scales of the seed coat; these are sure to occur if the flour has not been well bolted. Its presence is otherwise detected by the peculiar odour produced when the meal is moistened. Wheat with cockle seed should be rejected for sowing if the cockle cannot be got rid of.

Plan for ruling book in which to tabulate results of Seed-testing.

PLAN for ruling two opposite pages in book for tabulating results of seed-testing. This enables us to use plenty of space and fill in the most important details.

Left-hand page.

Name.	Obtained from—	Year grown.	Test commenced.	Vitality Examined. May 31	June 1	June 2	June 4	June 5	June 6	June 7	June 8	June 9	June 10	June 11
Algerian Oats.	G.C. 28/5/1900.	1899.	May 28.	6	9	31	46	1	0	1	0	0	0	1

Right-hand page.

Standard.	Per cent. Ger.	Remarks:—Purity, actual crop results, &c.
95	95	Fair Sample, size variable. Temperature 60. Method: wet blotting-paper.

References in "Agricultural Gazette" to Seed Testing, Good Seed, &c.

Acclimatised Seed—IX, 469.
„ Maize—XV, 793.
Age of seed—IX, 186; XIV, 196.
Cereals, Germnation of—XV, 392.
Choice of seed—I, 85; IX, 186.
Clean seed—X, 570.
Copper Sulphate for steeping—XVI, 473.
Cow Pea seed—XIII, 873.
Examination, at H.A. College—IX, 700; XII, 956; XIV, 264.
Farm seed, does it pay to save—XI, 374.
Formalin, for dipping—XV, 581.
Germination, testing for. (*See* Vitality.)
Germination in tubes—VII, 818.
Germinator, Home-made—X, 331.
Good Seed, Advantages of—XV, 266
„ Importance of—XV, 352.
Graded seed, cost and utility of—XIV, 197
Graders Illustrated—XIV, 198.
Grading—VIII, 855; XIV, 33, 145.
Grading, conclusions respecting—XIV, 204.
Grading Machinery—XIV, 199.
Grass seed, Native, Saving of—X, 704.
Hard Seeds—XVI, 399.
Kangaroo grass seeds—IX, 699.
Large seed, Advantages of—IX, 183; XIV, 33, 205.
Lucerne seed—XIV, 356, 832.
Maize seed, Saving—XIII, 1043.
„ Selection and Improvement of—XIV, 1037.
Mixed seed, Causes leading to—IV, 503.
Paspalum seed—XIV, 262, 1045.
Passing through stock, Seed—X, 526.
Pickling seed—I, 89; XV, 352, 581; XVI, 473; X, 700.
Protecting seed against Birds—X, 706.
Purity—II, 139.
Rape seed, Harvesting—VII, 643.
Saving seed—II, 225.
„ Cabbage seed—II, 225.
Second germination—XV, 786.
Seed, Choice of—I, 85.
„ Good, Advantages of—XV, 266.
„ „ Importance of—XV, 352.
„ Selection of—III, 656; 1031, V, 737; XI, 267; XIII, 1252; XIV, 33.
„ Selling, Frauds in—XIV, 1229.
„ Smut, Treatment. (*See* Pickling.)
„ Wheat—XIV, 33.
Shrivelled grain, Disadvantages of—XIV, 33, 151.
Sieves for grading—XIV, 34, 200.
Size, large *v.* small seed—IX, 183.
Small seed, Disadvantages of—XIV, 33, 147; IX, 183.
Smut, Estimation of spores present—XV, 670.
Sound seed—X, 570.
Sugar-cane seedlings—II, 117, 428; IV, 532.
Testing seed—X, 329; XI, 856.
True to name, Keeping seed—IV, 503.
Ungraded seed, Irregularity of stand from—XIV, 193.
Vitality of seed—II, 139; X, 329.
„ Effect of steam on—XIV, 26.
Weeds in crop seed—IX, 358.

Monthly Weather Report.

HAWKESBURY AGRICULTURAL COLLEGE.

Summary for October, 1905.

Air Pressure (Barometer).			Shade Temperature.				Air Moisture Saturation = 100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 13 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for 8 years.	% of the year's Evaporation.
29·44 24th.	30·33 2nd.	29·91	31·8 9th.	87·6 6th.	58·62	63·09	40 1, 11, 19, 27, 30.	87 4th.	57	·250 30th.	4·608	4·437	9·9

Rainfall												Mean rainfall for 13 years.
Dates	10	11	12	13	14	16	17	18	22	30	Total,	
Points	1½	4	3	13	6	16	2	2	61	1	109½ points.	133 points.

	N	NE	E	SE	S	SW	W	NW
Wind ...	1	11	1	3	5	7	6	7

Thunderstorms on date—16th.

Greatest daily range of temperature, 47·2—6th.
Extremes of rainfall during October—0·358, 1900; 3·489, 1898.
Days on which the max. temperature rose above 80° F.—6th, 11th, 22nd.
Frosts occurred on dates—1st, 9th, 10th.

Remarks:—The coldest October experienced since the College opened. The lowest monthly mean temperature prior to this month was 60·9 in 1899. This, with the extreme dryness, has kept everything back. Only one useful rain fell. The wind has also been in excess, causing greater evaporation than usual.

CHAS. T. MUSSON.

Ducks and Duck Farming.

[Continued from p. 1076.]

D. S. THOMPSON,
Poultry Expert, Hawkesbury Agricultural College.

VI.

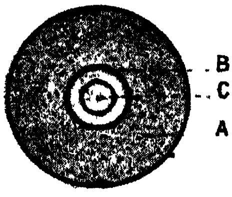
INCUBATING AND BROODING—NATURAL AND UNNATURAL.

Natural.

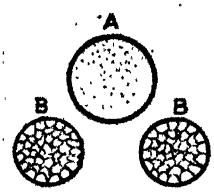
THE natural way of reproducing stock in poultry is for the birds to lay eggs, and then from a natural instinct to go broody, the body heat rising from about 98° F. natural to 103° F. fever, with a natural desire to sit upon the eggs and cover them until—by the heat of the body—the fertilized germ starts in embryonic life, and after a certain duration of time, when developed, breaks through the shell out into the world. After the fevered bird has succeeded in hatching out the young one, her natural instinct induces her to brood over it and to keep it warm, and to look around for a living for it. Hens, ducks, geese, turkeys, pheasants, &c. &c., have all had this natural propensity in their wild state, but to-day the propensity has been bred out of some species in domestication.

Among those who have lost the sitting propensity is the duck. The Aylesbury, the Pekin, the Rouen, the Indian Runner, and in fact all varieties of ducks, have lost this natural propensity. Now and again specimens of those breeds of ducks will go broody, but this is exceptional and certainly not the rule, and it would not be wise to trust them with any eggs for incubation. Sometimes the propensity is brought back by reversion. A common opinion among breeders and experts is, that if a Leghorn or Minorca, or Andalusian, or any of the non-sitting varieties, go broody, it indicates impurity, or a crossing with some of the Asiatic or some of the sitting varieties. Such is not the case always; in fact, in the greater number of instances it is brought about by reversion, by the sudden introduction of alien blood, although of the same variety. The duck having lost this natural propensity to sit, how then can you have natural incubating and brooding? The only possible practical way is to bring in some foster mother in the shape of the hen, or the Muscovy duck. The hen has been largely used in England, and is in fact largely used to-day.

Some duck farmers in Buckinghamshire, and in Bedfordshire, raise as many as 10,000 ducklings in one year, and the whole of those are hatched out with hens. Hens will sit on duck eggs without any trouble, will hatch them out successfully, and will brood them just the same as though they were chicks; and now that it is generally known that ducklings can be quickly fattened without any resource to swimming water of any kind, hens could be used very successfully to incubate, hatch, and rear ducklings. A flock of Buff Orpingtons would be far

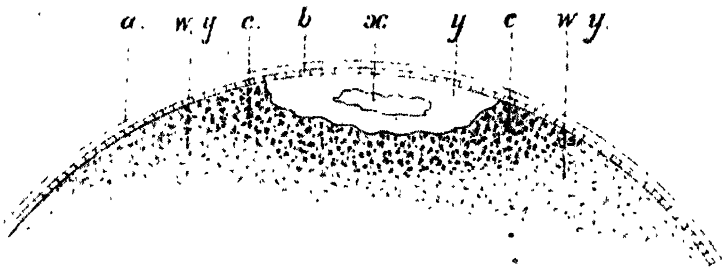


(*a*) Granular protoplasm. (*b*) Nucleus.
(*c*) Nucleolus.



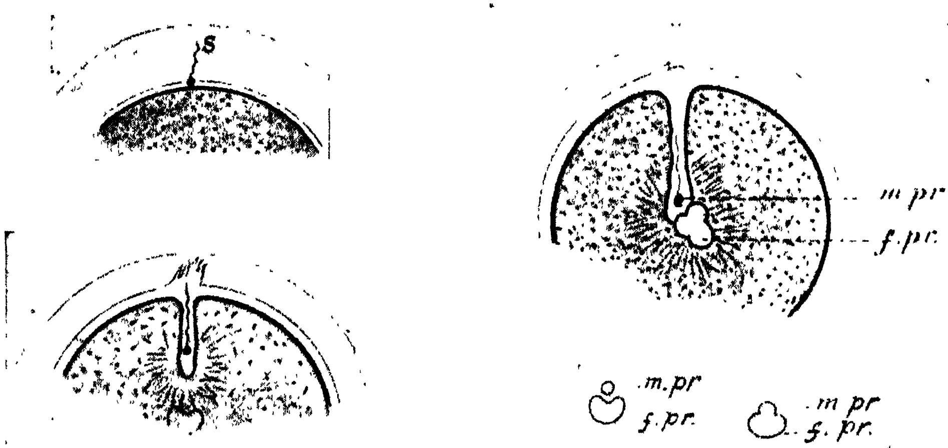
The Yolk.

(*a*) Spheres filled with granules (yellow yolk).
(*bb*) Vesicles containing refractive bodies (white yolk).



Section through the germinal disc of the ripe ovum of a fowl while yet enclosed in its capsule (after Balfour).

(*a*) Connective-tissue capsule of the ovum.
(*b*) Epithelium of the capsule, at the surface of which nearest the ovum lies the vitelline membrane.
(*c*) Granular material of the germinal disc, which becomes converted into the blastoderm.
(*w y*) White yolk which passes insensibly into the fine granular material of the disc.
(*x*) Germinal vesicle enclosed in a distinct membrane, but shrivelled up.
(*y*) Space originally completely filled up by the germinal vesicle, before the latter was shrivelled up.

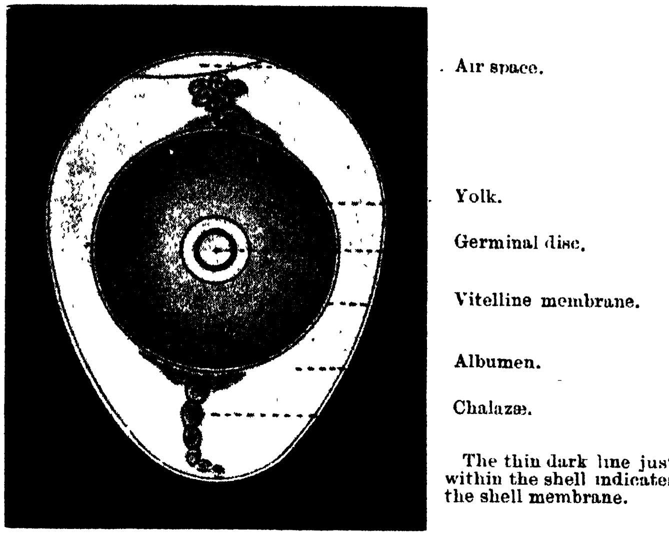


Fertilization of the ovum (after Quain).

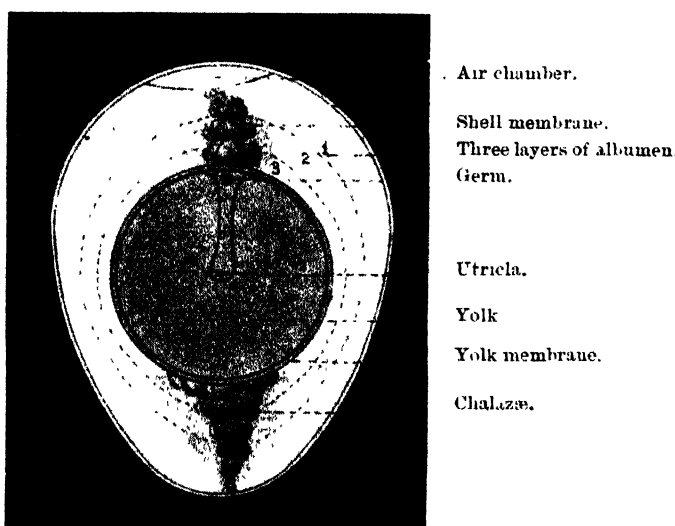
(*s*) Spermatozoon.
(*m. pr.*) Male pronucleus.
(*f. pr.*) Female pronucleus.

FERTILIZATION OF THE EGG.

the best for this purpose. They are a very hardy breed, easily bred and easily reared—that is, if you keep away from the unnecessary fad of buff throughout, which has already almost killed this grand breed. They will grow fast, grow large, and are very docile and quiet, easily tamed and handled, and can be made to sit almost at any time, and take a family of chickens, ducklings, goslings, or almost anything with life in it, at any time. The alternate process to the hen in natural incubation and brooding is the Muscovy duck. They make good and reliable sitters and good mothers, but they are not too reliable at hatching time, as they often get restless on the nest and sit too closely, often smothering the young ducklings under them. Of the hen and the Muscovy duck, we prefer the Muscovy duck for better germinating results. The Muscovy duck will start and successfully germinate the embryo up to hatching point more successfully than any other form of incubation, either natural or unnatural. A good profitable duck farm could be run by using either hens or Muscovy ducks for hatching and brooding. But the Muscovy will start the germ more successfully than any



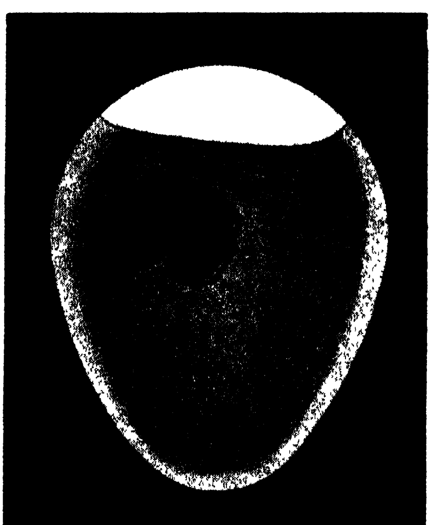
Egg of Fowl in longitudinal section (after Marshall).



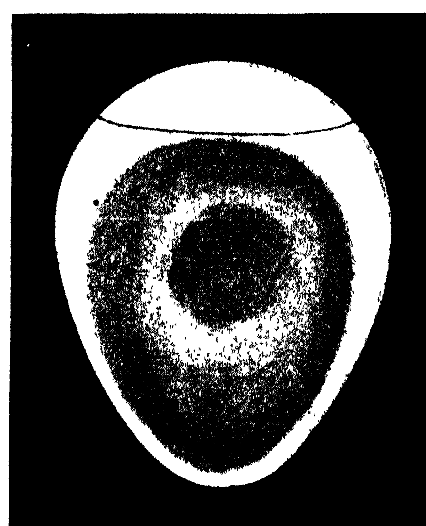
A Fresh Fertile Egg.

artificial incubator. A good plan is, therefore, to set a large number of Muscovy ducks at one time—say ten ducks with twelve eggs each, or a total of 120 eggs. At the end of forty-eight hours they can be tested out, and the infertile eggs can be sold. A fair fertility will give you 50 per cent. fertile. That will relieve half of your ducks, only allowing five ducks to go on with the fertile eggs, when they will successfully incubate every fertile egg. The next point of importance is that you remove the whole of the eggs, two days before they are due, to artificial incubators to be hatched out. If you have a hatch of fifty: you can put all that lot with two ducks, twenty-five to each, and place them in a large shed or brooder house, sufficiently large for them to exercise in until they are two or three weeks old, and also afterwards when it is wet or stormy weather.

Strange to relate, ducklings want even more protection from the wind and rain than chickens. A good thunderstorm will very often drown a whole flock of ducklings. In rainy weather the expression is often heard, "Fine weather for young ducks!" This may be correct after they are feathered, but certainly not when they are in the down, as they are easily drowned in the pelting rain. After they are a fortnight old they could be let out daily in a small grass run—not too large, or they will wander all over it and run their fat off. The process could be repeated, and with about fifty Muscovy ducks for incubating and brooding, 500 ducklings could be easily and profitably reared. This we believe to be a better process than hen-hatching,



A Dead Germ.

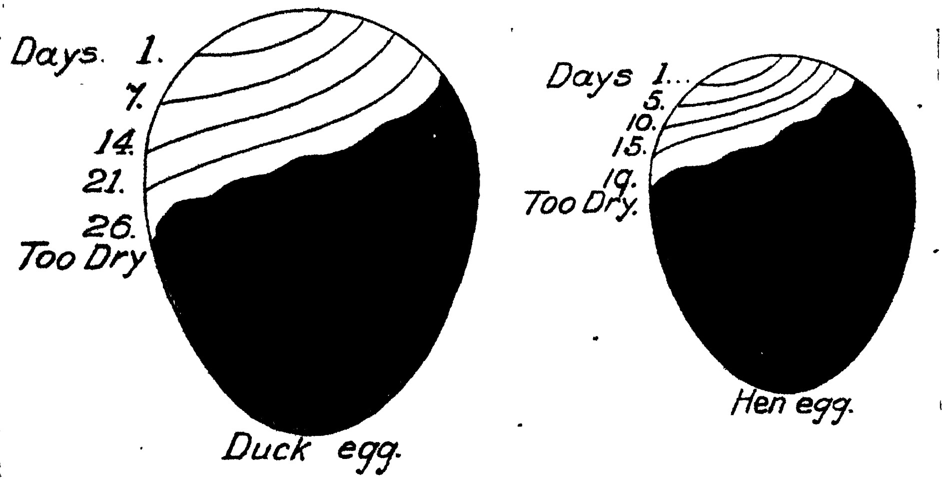


An Infertile Egg.

but the hen-hatchery could be successfully carried out on the same plan. In setting your hens or ducks, the best plan is to have a long row of nest-boxes, with short wire runs in one large frame in front of them. With this plan you can set up to fifty hens or ducks, and with large watering fountains and fairly large maize-hoppers, you will have

no trouble and no work, but may simply leave them to themselves after testing out until hatching time.

Several English duck farmers are now employing artificial hatching;



but Muscovy ducks are almost unknown in England, and are never used for hatching.

In America natural incubation has gone entirely out of fashion, and machines are now more largely used in America than in any other part of the world.

Unnatural.

Unnatural or artificial incubation and brooding has been found a distinct success in regard to duck-farming. The machines, although brought up to great perfection, perfect enough to make artificial hatching profitable, have not yet come up to the hatching and incubating success of the Muscovy duck; consequently everything has to be done to give the machine a chance to make up for its deficiencies.

First of all, then, extra care must be given to the selection of your breeding stock. Second-year ducks and first-year drakes will give the strongest fertility, and about five ducks to a drake. They must be well attended to, well fed, and never short of good clean water. Plenty of room, and plenty of grass land, and quiet quarters and surroundings. Ducks frequently disturbed by dogs, or even by people, and especially during the night, is a cause of infertile eggs, this is very seldom heard of as a reason, but we know it to be a governing cause. The eggs must also be collected regularly and early each morning, otherwise they are likely to lose fertility by exposure to the weather. Then they must be carefully stored in a room of fair temperature, where they will not get chilled or overheated, small end down. Don't turn them—only waste of time, and more liable to destroy fertility. Place them in the machine a few days after gathering, as fresh as possible, as many germs die in duck-eggs, from various causes, and will not germinate, if the egg is at all stale. Every effort should be

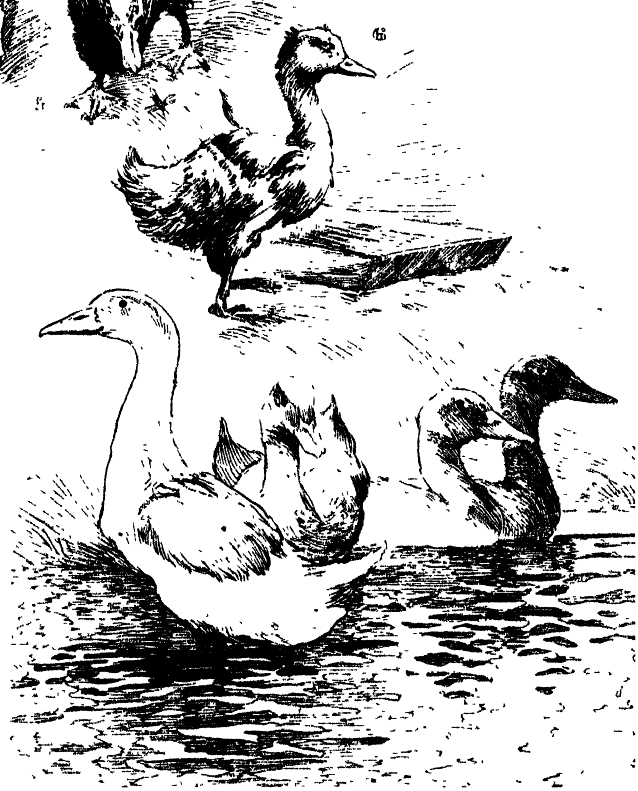
made to fill up your machines before your first eggs are over seven days old; this tells you that it is not wise to have very large machines—120-egg size is large enough, and even for those in a fairly large way a number of 120-egg machines is much better than a smaller number of large ones. Differently to the advice of others, we advise putting the eggs in a cold machine and then lighting up, allowing the machine to heat up slowly. Many germs are killed through a too sudden application of heat. For duck-eggs, if the thermometer reads 100° F. after eight hours, this will do for the first twenty-four hours, increasing to 102° F. for the second twenty-four hours, and then running up to 103° F. for the remainder of the time.

Although the machines are called self-regulating, there are no perfect self-regulating machines on the market so far, and we have not yet heard anything more definite of the electric Regulator.

In the absence of a perfect regulator, you will have to give a good amount of your attention to regulating your machine to keep it to as even a temperature as possible right through. At one time nothing was left to the machines, the manipulator exercising great experience and judgment in running them; and the Egyptians and Chinese used to successfully hatch chickens from mud ovens. But now, with our more perfect machines, people expect too much of them, most people thinking that all you have to do is to put the eggs in the machine, light the lamp, and let her go, expecting that all they have to do is to wait for the lapse of time and take out the chickens. But even with our up-to-date machines, and with the latest devices of regulating gear, with capsules, thermostats, and thermometers, we cannot come up to the Egyptians in hatching out chickens artificially. We leave too much to the machine, and—the machine having no brains—hence the many failures at artificial hatching. As far back as 1777, Dr. Bonnemain supplied the Paris market with chickens hatched artificially, and since that time many improvements have been made in machines, but we get no nearer the perfection of the crude methods of the Egyptians. Eggs for incubating purposes should be as fresh as possible, and while you may set eggs after fourteen days with hens or ducks, every effort should be made to have them under ten days, if possible, for the machine. Many eggs will hatch out although fifteen, twenty, or even thirty days old, but then you have a much greater mortality amongst your young stock. As an egg becomes old the air-chamber increases by the inhalation of the outside atmosphere, in which case the natural incubation of the chick is in danger from the influx of too much oxygen. The time required for incubating naturally is twenty-eight days, but ducklings will often hatch out in machines at twenty-five days. Eggs for incubation should not be too small, nor too large, but just the normal size generally laid by the breed and strain of duck. They should be of good shape, and sound. It is no use putting down cracked eggs, or eggs rough in shell or in any way misshapen. In both natural and unnatural incubation, while scientific care and attention will give you good results, and make a profitable industry, unskilled work, unscientific methods, and carelessness will give bad results, and turn a profitable industry into a losing one.

Whatever the question may be, in regard to natural and artificial incubation, everyone will concede that to produce the large number which is necessary to make a profitable industry out of duck farming, it is absolutely necessary to have recourse to both methods.

Artificial incubation was known and practised thousands of years ago by the Egyptians, and the hatchers were very skilful at their work, and the whole process was conducted, and regulated by, the hatchers. It is marvellous how many people make failures at artificial incubation. We



have many kinds of incubators on the market, all of them giving good results, more or less, if well looked after, and well understood. Several of these machines are built on somewhat different principles. Some of them are what are termed "hot-air machines," that is, the heating of the chamber from a tank over the eggs, which is heated with hot air from a lamp. Then there is the hot-water machine. These

machines contain a tank over the eggs which is filled with water, and this water is heated from a lamp, just the same as the hot-air tanks. There is a difference of opinion which is the better, each maker claiming some benefit to be derived from the one which is not to be derived from the other. However, our unbiassed verdict is, that, so far as hot-air heating tanks and hot-water heating tanks are concerned, there are six in the one, and half a dozen in the other.

The hot-water machines are generally more expensive, as the tanks require to be made of copper, which is an expensive metal, but it is far better, if a hot-water machine is to be purchased, get the copper tank, as an iron tank soon gets perforated and becomes useless. The machines are called self-regulating, but it is only with the attention and assistance of the manipulator that they will regulate so as to carry an even temperature. They all have regulating gear attached to them which is of vast assistance to the hatcher. Some of them are regulated with what is called a thermostat, that is, bands of aluminium strapped on to bands of iron and placed inside the egg chamber. As the heat in the egg chamber rises, the aluminium expands with the heat, and, as it is riveted to the iron bands at the ends, it cannot stretch,

Drinking Fountain and Water Trough.

and consequently bucks in the centre, and operates on a pin, which raises or lowers a damper over the flue from the heater, and thereby raises or lowers the heat in the egg chamber, by the damper either shutting in the heat or allowing it to escape.

Then we have the capsule and trip system. A capsule, or small metal cavity, is filled with some spirit which expands with heat, and this capsule is placed in the egg chamber, and on it the regulating pin is placed, and with the expansion or contraction of the capsule the pin rises or falls according to the heat in the egg chamber, and as the pin rises the light is shut off, and the chamber gradually cools, and *vice versâ*. The best-known machines in this State worked with the damper are the Cyphers, the Prairie State, The Ideal, and The Successful. And those with the capsule and trip are the New Zenith, the Nonpareil, the Petaluma, and the Preddy.

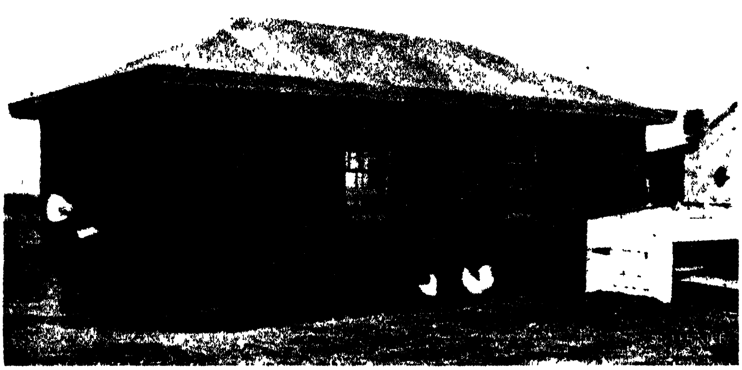
The New Zenith, the Nonpareil, and the Preddy are all locally-built machines, and we can, from experience, say that they are at least equal to anything on the market.

After putting your eggs in the machine and shutting her up, and having her running steady at 100° F., you can, within forty-eight hours of running at that heat, successfully test out all your eggs, and only replace the fertile ones in the machine, gradually increase

the heat to 103° F., and from that on you should turn the eggs every twelve hours, cooling the eggs for a few minutes each time, gradually increasing the time of cooling during the third week of incubation, and gradually diminishing again towards pipping time. When you notice your eggs pipped, shut down for the remainder of the time and allow the machine to do her own work. But after, say, three days of hatching many ducklings can be saved by liberating them from the shell. After testing out for the first time, it is a good plan to run over your eggs, at any time when you are turning them, on the outlook for dead birds, as the dead embryon will give off a very large amount of carbonic gas, which will be injurious to the life in the chamber. It is always necessary to be with your machine every night just before retiring, because, if it is running too high, the continuous high temperature of the long night will spell death to the embryon in the chamber.

The Construction of Incubator Houses.

In the construction of an incubator house, it is necessary to be particular in some details. In the first place, whatever the building is constructed of, it should be constructed in such a way that it will have as even a temperature as possible in the room; the next is that it should be well ventilated, but by a slow process; also it should have little vibration, particularly on the floor. The illustration shows the incubator room at the College. It is not a very large room, and it contains twelve machines of different makes. The room is built of



Incubator House.

brick, with thick walls, and runs a very even temperature in the room. The foundations are solid and the floors cement, so that there is no jarring on the machines. The ventilation is right from the bottom, and by a slow process rises to the highest part of the roof, and escapes slowly at a lower point, viz., the eaves of the building, consequently there is no draught or rush of air, yet the ventilation is pure and sweet all the time. In setting the machines in the incubator house, care must be taken that none of them come under the direct rays of the sun. Any machine will be unduly affected by this, but some more than others. The hot-air machines will be most affected, and some makes of those more than others. Some machines, set directly under

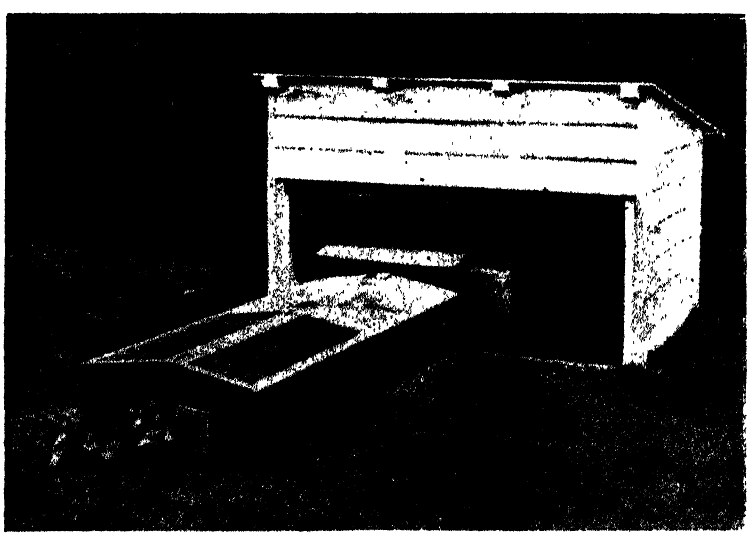
the rays of the noonday sun, on a hot day will rise to an excess of as much as 10° F. Nearly all incubators are made for kerosene lamps for generating heat, but any maker could make machines to run with gas or electricity, although it would require much alteration in some of

Interior Incubator House.

them. The Cyphers machine could, however, be run with gas or with electricity without any alteration. A much cleaner and safer method than kerosene oil, would be an installation of acetylene gas.

The Construction of Brooder House.

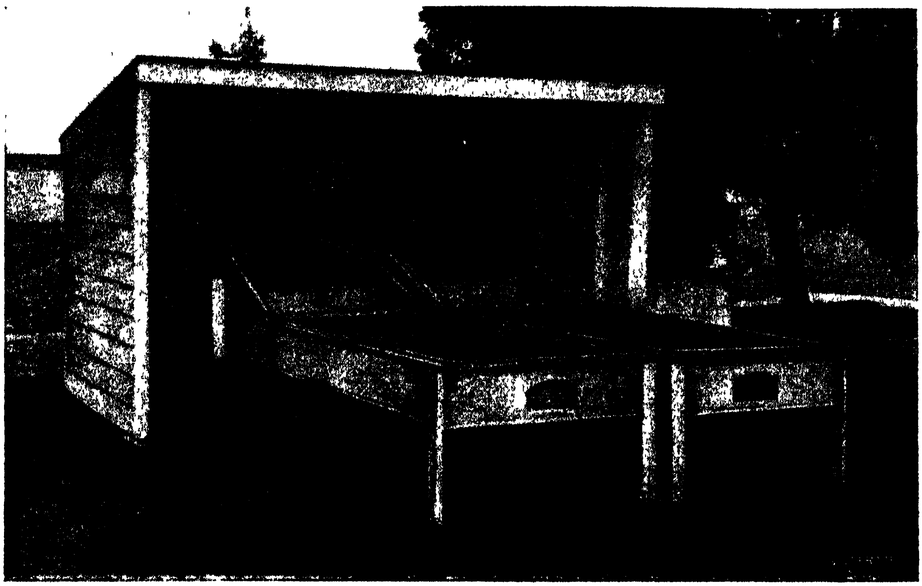
To anyone going in for artificial hatching, a brooding house is absolutely essential. Whether the hatchings from the incubators are



Nonpareil Brooder set on the ground.

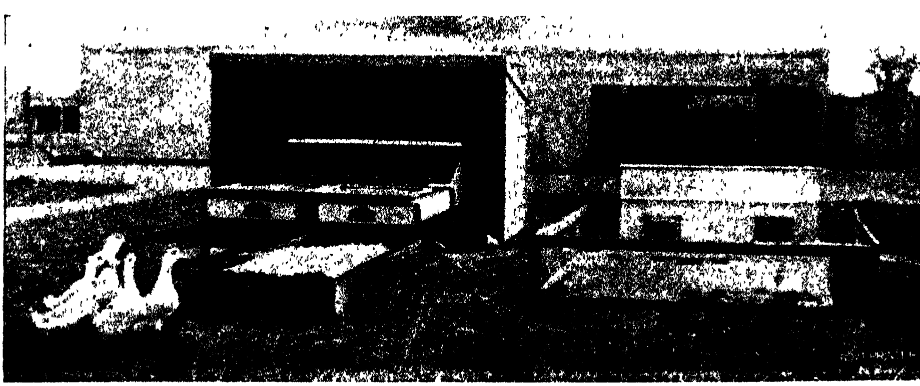
given to foster-mother hens, or foster-mother ducks, or foster-mother boxes, the brooder house is a necessity all the same. It should be

constructed of a fair width, and of as great a length as your capital will allow. The brooder house shown in the illustration is built of wood and covered with ruberoid, and is 15 feet wide and 120 feet



Zenith Double Brooder.

long. The floor is sand, and ducklings or chickens can be brooded. With a brooder house like this very little artificial warmth is necessary. In this house ducklings can be brooded with hens, or with Muscovy ducks, or with artificial brooders; the ducklings only requiring artificial heat for the first seven days, so that there is very



Zenith and Home-made Brooders.

little difficulty in brooding young ducklings artificially. The Non-pareil and The Zenith brooders are both locally-built machines, and make successful brooders.

Young ducklings just require enough heat to keep them comfortably warm, and in the spring and summer season, if they are hatched in

fairly large numbers and housed in suitable brooder houses and in suitable brooders, they can soon be weaned of artificial heat. Ducklings require frequent feeding, but we do not advocate any fancy work. Our mash is one-third bran, one-third pollard, and one-third maize meal, the mash to be fed at intervals, and maize meal and sand constantly before them. For a watering utensil for the first three weeks, we find the Lithgow fountain, as shown in the illustration, suitable in every way; while for those from three to twelve weeks we find the tin spout, covered with mesh wire to keep them out of the water, very suitable. The watering utensils ought to be placed on perforated zinc to keep them dry. Hundreds of ducklings die from paralysis of the spine, caused by dampness; and if the slops—and young ducklings are continually slopping—are carried through the perforated zinc, the ducklings are always nice and dry, and will thrive much better than if allowed to slop in the water on the ground spilled from the water utensil. After the first ten days, while not absolutely necessary, a little meat feeding will help the ducklings along, and also a feed of

Long Brooder House.

chaffed green lucerne once a day will do them good and help to keep them in good health. Sand floors, covered with some oaten straw, and frequently renewed to keep down dampness, will save many of your ducklings from paralysis, or what is generally known as staggers, and what is often attributed to all sorts of reasons except the right one. When young ducklings get paralysis of the spine, it is a sure sign they have been in damp quarters.

You will frequently read, "Run your brooders at 95° F. or 100° F. for the first week;" but, while it depends on the weather and time of the year, in the spring and summer, when most ducklings are hatched, we find 75° F. warm enough, even for the first week, and after the first week we dock the artificial heat altogether. Ducklings should always have plenty of shade from the sun, as they are very easily sunstruck, but will stand an immense amount of actual heat so long as they are

shaded from the direct rays of the sun. In regard to running bees in conjunction with a poultry farm, it is well to mention that where an apiary is in the vicinity of a poultry farm, in the warm weather the bees will be found in hundreds drinking from the water utensils for the poultry, and young ducklings will gobble up the bees wholesale; but eventually by instinct the bees will show fight and wage war on the ducklings, and will come off victorious in the end, when you will find your ducklings lying all around the battle-ground by the score, dead as doornails. The sting of the bee is almost instant death—the ducklings invariably dying within a few seconds of being stung.

"Do not overcrowd," says the general writer; but we have always found well-stocked brooders the most successful.

The great secret in successfully brooding artificially is to get rid of the artificial heat as soon as possible, without starving your ducklings or chicks with cold. With 100 ducklings in a suitable brooder in the summer time, it would be found you could dispense with the lamp heat in about seven or eight days at the latest, whereas with only about fifteen or twenty ducklings in the same brooder you would require to keep the lamp heat going for four or five weeks, before your ducklings would feel comfortable without the artificial warmth. With the greater number the natural heat would keep them warm, and they would thrive much better without it, besides there being no fear of overheating, which is a general cause of mortality in chicken and duckling rearing in artificially-heated brooders. More chicks and ducklings die from heat than from the want of it.

The duck breeder must always recollect that he cannot give the young ducklings too much attention, nor can he give them too much cleanliness and dryness in their quarters. Ducklings can easily be taught to feed at night, and it makes them tame; they will come out and feed at any time of the night by lamplight or any artificial light, and by this means they can often be hurriedly fattened for any particular market. While the food in general should be mixed dry and crumbly, they will very often appreciate a change now and again to a wet mash.

Although it is the best guide to watch the comfort of the ducklings as regards increasing or diminishing the heat, it is absolutely necessary to have a thermometer in the brooder, so as to know whether the heat is falling or rising at the different intervals of the evening from roosting-time until your own retirement. The floor of the brooder should always be covered over with straw, to keep them dry. If ducklings are kept dry, and their feet warm, all they will want is plenty of food to make them grow.

Rats, native cats—and tame cats sometimes—crows, and hawks, are all very fond of ducklings. Hawks and crows can be guarded against during the day, and the brooder house ought to be at least cat-proof during the night. Against the rats, which are the worst enemies of the ducklings, and which are the hardest to cope with, we have found nothing to beat the tame cat, the natural enemy of the rat, trained to sleep and stay in the ducklings' quarters. The other enemy of the poultry yard, disease, is not found in duck farming. Ducks are

almost immune to disease, and if they are not neglected they are entirely immune. There is no hereditary disease in ducks, and by care and attention epidemics will never occur. In regard to attention in feeding and watering, never let their water-fountain run dry. Make this an absolute rule. Always have dry food before them, crushed maize and wheat, but only feed mash to them occasionally, and when fed give them just as much as they will eat up clean within a few minutes after being fed. It takes a lot of bad feeding to affect a duckling, but they fatten and grow very much more quickly with fresh sweet mash every time served up to them, instead of that allowed to remain on the ground or in troughs. They can always get plenty of the dry meal between the times of feeding the mash, so that there is no necessity to put down the mash to keep them feeding for some time.

Amateurs, and even experts for the matter of that, are instructed by theorists to run their brooders dangerously high, and the least fluctuation of high heat is dangerous and injurious to the aeration of the bones. No doubt it will surprise many people, as we find it does surprise them, to find that fowls and ducks not only breathe through the nostrils but actually through the bones; and we have concluded that the overheating in brooders forms an imperfect bone which is not porous, and later on a percentage of chickens die from a deficient aeration of the blood. In young chickens the bones are filled with marrow, and we believe that when chickens are brought up in a vitiated atmosphere, and overheated, the bones never become pneumatic, and the complete aeration of the blood cannot be effected. If we are correct, the electric regulator would be of untold value.

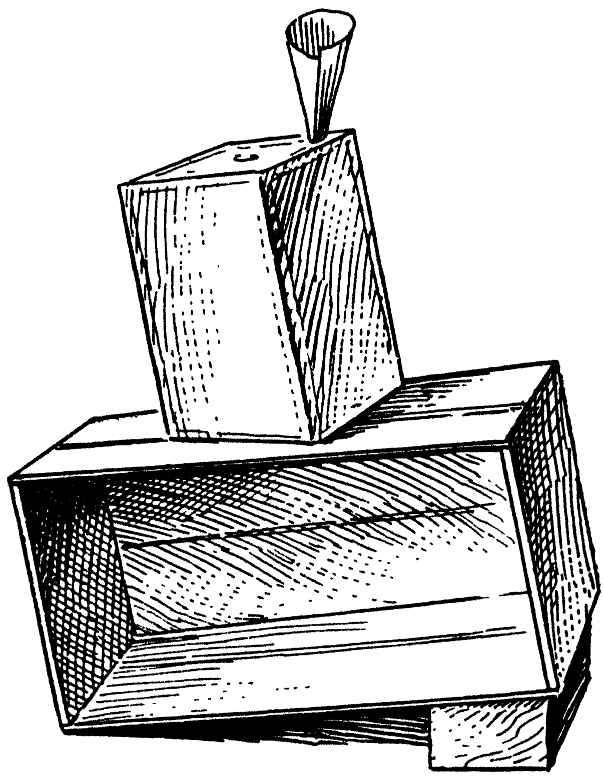
(*To be continued.*)

Fruit Pulp on the Farm.

G. R. HARRISON, Tenterfield.

THE season for summer fruits is fast approaching, and once again we will have to face the problem of caring for the various fruits, that we may enjoy them all the year round till another fruit season comes in.

The man with a few trees, producing more than the family can consume immediately, but not enough to market; and the man near the market, who can buy cheaply during gluts; and the market grower, who has much that the market will not take, all want a method of keeping fruit on a larger scale than the ordinary preserving bottles permit of. All such will be glad to hear how I have, on three separate occasions, put down fruit in 4-gallon packages at cost in cash which was trifling, and at a cost of time, skill, and labour which even very busy people could afford.



I will describe how I put down both peaches and quinces at the "Orange Grove," while the guest of Mr. James Metherell, orange-grower and bee-keeper on the Colo River, some eight or nine years ago. Seeing that much fruit was likely to be wasted, though Mrs. Metherell had filled all available receptacles with fruit and jam, I got all the available empty kerosene cans, carefully melted off the circular cap, and soldered up all other holes. To remove all trace of kerosene, a few pints of dry dust (ashes or garden soil) were poured in and shaken up so that it reached all corners, and they were left in the sun, getting an occasional shake now and then. In a couple of days this was poured out, and the tins were washed with cold water just to wash out the dust; they were then ready. My first batch was peaches; these were picked over, stalks pulled off, but were neither peeled nor stoned

(they would probably have been better peeled, but all stone fruits improve in flavour if preserved with the stones in them). They were placed in a boiler, and as little water added as they could be boiled with, and as soon as cooked they were lifted with a dipper and poured through an improvised funnel—simply a piece of tinned sheet about the size of the head of a kerosene tin (which probably it was) rolled in a cone and cut off so that it would just about fit the holes into the cans. The cans were stood on a sloping board, so that the corner with the hole in would be the highest point. This allowed the cans to be well filled, and yet the fruit was clear of the edge of the opening. The edge of opening was then wiped clean and dry, and the caps which had been taken off were securely soldered on again, and the whole process was complete. The cans were then removed to a cool place—underneath the house is where I have stored them mostly—and there left till wanted. As the fruit cools, the sides of the cans are drawn in, and this assures you that the tin is air-tight; if the sides bulge out much at any time, you may be sure that there is a leak, and that the fruit is fermenting. I have put down some thirty cans of different fruits in different years and places, but have not had a tin go bad, and many were kept for two years.

Soldering Outfit.

When a tin is opened, it may be made into jam or may be heated up and poured into ordinary preserving bottles and kept till wanted.

I have found that it takes about one-and-a-half times the full of a kerosene tin of the fresh fruit, before boiling, to fill a can with the pulp—say, a kerosene case three parts full.

Some people may be afraid they cannot use the soldering tools, but they need not fear, it is exceedingly simple. The tools and materials required are a proper soldering bolt (will cost about 2s. 6d. in Sydney), about 3d. worth of "spirits of salts" (Hydrochloric acid), and about 6d. worth of tinman's solder, a few bits of clean tin sheet for covering holes knocked into the cans for the purpose of emptying them. A small pair of tinman's shears, say, 8 or 9 inches, are very handy.

How to solder.—First clean the parts of the copper bit of the soldering bolt with an old file, and heat it in the fire till it just begins to change colour. Have a vessel, an empty jam tin will do, half filled with water, and drop into it six or eight drops of the raw spirits of salts, also have a glass or

delf vessel and pour into it about a table-spoonful of the spirit and twice as much water, and into this drop small pieces of zinc, the liquid will commence to boil furiously, giving off pure hydrogen gas, and will eat up the zinc; keep putting in the zinc till it will eat no more when, instead of having hydrochloric acid, you will have a solution of the chloride of zinc. This is your soldering liquid, and may be laid on the parts you wish to solder with a brush or feather, or even a bit of cane or stick with the end bruised. When the bit is hot enough to begin to colour, put a little piece of solder on to a piece of clean tin, and put a little of the soldering liquid on it. Dip the point of the bit into the acid water in the tin for a moment—this cleans it—and put it on the little piece of solder on the piece of tin. This should melt and spread over the cleaned point of the bit and over the tin; this is "tinning the bit." You may now put it into the fire and make it a little hotter, but do not make it too hot or you will burn it—that is, you will fuse the copper and the tin of the solder together and make bronze, and this will not work well and must be ground off, and the operation of tinning gone over again. Cut little bits of tin and lay them over any holes to be closed. Apply the soldering liquid, put a bit of solder on top and lay the tinned point of the bit on it, and keep it on till the solder is melted and has run down around and under the little patch of tin. Always keep the bit on till the solder has adhered well to the tin. It is well to run plenty of solder into the groove around the opening of the can, when it will be much easier to solder on the cap when the fruit is in.

I trust that during the coming year many farms and orchards will have some dozen of cans of pulp of various fruits, besides the usual amount in bottles and in jam.

Tins for the purpose can be obtained at several manufacturers in Sydney, and the cans with "slip in" lids, used by bee-keepers for honey, can be made quite air-tight if the lids are pressed well down and wax or mineral wax (paraffine) run in while the tin is hot.

To recapitulate, the steps in the process are:—First, procure and prepare cans; second, procure and prepare fruit; third, boil fruit with as little water as convenient. It will take about 6 gallons of the uncooked fruit to fill, when cooked, a 4-gallon can; but if you have cooked fruit enough over to partly fill a can, it is all right to keep that partly-filled can hot till more fruit is cooked to fill it; fourth, fill into cans while boiling hot, and solder down at once; fifth, store in a cool place.

[Care should be taken when buying solder to obtain a suitable grade; this material is made of varying quantities of lead and tin and sometimes bismuth. At the Wagga Experimental Farm, the solder used in the cannery is made of equal parts, lead and tin; this flows freely and does not take a great heat. A solder used for canning that is very good for many purposes, because it melts at a low temperature, is made as follows:—Lead, $1\frac{1}{4}$ lb.; tin, 2 lb.; bismuth, 2 oz. The lead is melted first, the tin is added next, and finally the bismuth stirred in well just before pouring. With a low melting point such as this, viz., 340° F., caps of pulp fruit-cans can be removed without having recourse to tin-openers or worse, thus damaging the can.—ED. *A. G.*]

The effect, in actual Farm Practice, of treatment with Bluestone on the Germination of Wheat.

W. FARRER.

An invitation was issued in the March *Gazette* to farmers to send in samples taken from bulks of the grain they had treated with bluestone, as well as from the same bulks before they had been treated. The main object of this invitation was to get an idea of the amount of loss of seed which is being caused in actual practice from treatment with this fungicide. The responses to this invitation were much fewer than had been expected, but still they have been sufficiently numerous to indicate that this loss is probably large enough to be of national importance; and it is hoped that the interest which is excited by these results may be the means of making the responses to a similar invitation to be more numerous next year. A few samples were received which had been treated with other fungicides, but they were too few in number to be of much value. Of course, this is not a report of all the effects of the treatments; but as we are now in a position to see what effects on the germination have followed a number of treatments with bluestone, and as some mistakes which have apparently been made with formalin in Victoria have excited considerable, and, as *at present*, I think, an exaggerated distrust of that fungicide, and have caused a reaction in favour of bluestone, I think the present time is opportune for making public the effects of the treatments with bluestone which are actually being practised by farmers on the germination of wheat.

	Variety of Wheat.	Date of Planting.	Fungicide used.	Strength.	Seed planted.	Germinations. 17 July.	31 July.	8 August.	Apparently killed by treatment.	% apparently killed by treatment.
1	Allora Spring ..	15 June	None ...	......	148	126	126	126	..	...
2	" ...	15 "	Bluestone	1 in 100	148	97	108	108	18	14·3
3	Dart's Imperial ...	15 "	None ...	......	148	140	143	143	..	...
4	" ...	15 "	Bluestone	1 in 100	148	136	140	140	3	2
5	Not given... ...	15 "	None ...	.. ...	148	138	138	138	...	...
6	Same as No. 5 ...	15 "	Bluestone	1 to 80	148	101	100	108	30	21·7
7	Not given... ..	15 "	None ..	......	148	125	125	128	...	...
8	Same as No. 7 ...	15 "	Hot water	......	148	82	88	88	40	31·2
9	Not given... ...	15 "	None ...	.....	148	126	127	127	...	...
10	Same as No. 9 ..	15 "	Bluestone	1 to 40 (about)	148	97	103	102	25	19·7
11	Power's Fife ...	15 "	None ...	.....	148	146	147	147	...	..
12	" ...	15 "	Bluestone	1 to 100	148	146	146	146	1	·75
13	Bobs	15 "	None ...	......	148	145	145	145	...	..
14	"	15 "	Bluestone	1 to 100	148	147	147	147	...	...
15	Jonathan	15 "	None ...	......	148	130	131	131	...	...
16	"	15 "	Bluestone	1 to 80	148	58	64	66	65	49·6
17	Not given... ...	17 "	None ..	.. ...	148	135	135	135	...	...
18	Same as No. 17 ..	17 "	Bluestone	(?)	148	102	104	108	27	20

I will first present my results in the form of a table. It will not be necessary to give the names of the farmers who sent the samples. So far as information is available, the details of the treatments will be given afterwards.

Taking the average of Nos. 2, 4, 6, 10, 12, 14, 16, and 18, which are the ones which were treated with bluestone, we find that the treatment killed 16 per cent. of the seeds. This average, it will be seen, is considerably higher than it was with the twenty-one varieties, which, in the experiments made at Cowra, and described in this issue of the *Gazette*, were immersed for five minutes in a solution of so great strength as 1 to 50. The seeds, however, in those experiments, were planted a considerable time, probably on an average about six weeks, after they had been treated, while in the Cowra experiments they were planted soon after they had become dry, and this may be the cause of some of the difference. Unless the experiments that I am proposing to make for the purpose of clearing up the point show that seeds which have been treated with bluestone do not, as is alleged to be the case after treatment with formalin, retain their vitality for long, the methods of treatment which are being practised with this substance kill an unnecessary number of seeds. It is desirable, therefore, that the best method of using bluestone be ascertained and adopted generally, and that "abouts," both of quantities and time, be avoided.

The treatment which Nos. 2 and 4 received is described by the sender as follows: "I put about 1½ bushel in a bag and dip it about five minutes in a 1 per cent. solution of bluestone." The treatment of No. 6 is stated to have been as follows: "We put 2 lb. of bluestone and 16 gallons of water into a cask and soak a bag of wheat in it for from five to ten minutes." No. 10 was treated as follows: "Half a pound of bluestone is dissolved in boiling water, then mixed with 6 or 7 quarts of water, then syringed over a bag of wheat which is kept shovelled." For Nos. 12 and 14 the method of bluestoning which was practised was "to put about 30 gallons of water into a trough, and then dissolve 3 lb. of bluestone in boiling water and mix," and into this to dip the wheat, 1 bushel at a time, placed in chaff bags and moved about until all the grains are wet. A description of the treatment of No. 16 is wanting. That of No. 18 is described by the sender in the following words: "I fill a cask in the evening to cover about 3 bushels. I put about ½ lb. of bluestone into the cask. This is enough to make an iron rod of a copper colour. I now put in the wheat and leave it until the morning. I then riddle some fine lime over it, and mix it up with shovels, and sow it while it is still damp."

It will be noticed that in the solitary case in which the treatment was with hot water, the loss of seed was 31·2 per cent., or about twice as great as the average for the treatment with bluestone. This is worth noting, for the hot-water treatment is not only tedious, but, unless special appliances be provided, difficult to carry out properly. None of the treatments which are in use are, as a matter of fact, entirely satisfactory. If we can only get varieties whose resistance to the infection of bunt is sufficient to cause treatment, or at any rate, severe treatment, with fungicide, to be unnecessary, the saving of seed will be great enough to be of very substantial importance.

The Effects of some Solutions of Formalin and Bluestone, which are in common use, on the Germination of Wheat-seeds.

W. FARRER AND GEO. L. SUTTON.

THE experiments, of which the following tables give the results, were made at the Cowra Experimental Farm for the purpose of testing the soundness of the conclusions which have been drawn from the previous experiments with fungicides made at Lambrigg. This, we felt, it was desirable to do, because the so-called formalin-fiasco, about which we have lately heard so much in Victoria, appeared to stamp them as being of doubtful value. We have also thought it possible that this alleged fiasco might, to some extent at any rate, have had its origin in differences in the strength or quality of the brands of formalin which are on the market; or that it may possibly have been caused by the unequal ability of varieties of wheat to withstand treatment with this fungicide. In these experiments the examination of the relative effects of formalin and bluestone on the vitality of the seeds has been made by subjecting a number of varieties (21) to the same treatments, and taking averages of the results. The percentages of seeds which were apparently killed by the treatments have in each case been arrived at by calculating the number of germinations which would have occurred for the same number of untreated seeds as were planted, and taking the difference between this number and the number which actually germinated. It will be observed, however, that in some cases the number of actual germinations for the treated seeds was greater than the same number of untreated seeds would have yielded—that, in fact, treatment with the fungicide apparently had the effect of increasing the germinating quality of the seeds. In such cases the sign of subtraction (—) has been placed before the number representing the percentage killed. Although, on account of the relative smallness of the number of the seeds which were made use of in it, such anomalies might in any case be looked for in an experimental investigation of this character, in this case their number has most likely been increased by some oversights which will be avoided in the repetitions of these experiments which it is our intention to make. These oversights were:—(1) That a greater number of untreated seeds was not planted, and in this way the percentage of germinations made to be more valuable as a standard for comparison; (2) that the light (floating) seeds were not taken

from the untreated sample, as they were, by being skimmed off, from those which were treated with formalin and the solution of bluetone. These oversights have deprived our experiments of some of their value, but enough remains to render a report of them worth making.

The following procedure was adopted in treating the grain with the fungicides:—Solutions of the required strengths were prepared just before they were required. The quantity of seed allotted to each plot was placed in a suitable vessel, and the fungicide poured over it. Light grains, chaff, &c., which floated on the surface, were removed. After the grain had been immersed for five minutes the solution was poured off; the grain was then dried in the sun, and planted soon afterwards. Every care was taken to ensure that only apparently good seed (whether treated or untreated) were planted.

The soil at the time of planting was in good tilth and moderately moist, but rather cold. The rainfall during the trial was extremely favourable for germination, and so opportunely did showers fall that at no time during the trial were we without rain for a sufficiently long period to allow a crust to form on the surface of the soil.

The rainfall recorded during the trial was as follows:—

August	21	3 points.
	27	98½ ,,
	29	2 ,,
	30	18 ,,
	31	3 ,,
Sept.	6	16½ ,,
	7	1 ,,
	10	12 ,,
	11	12 ,,
	14	1½ ,,
	15	2 ,,
	16	12 ,,

The record shows how favourably the rainfall was distributed whilst the experiment was being conducted.

The counting of the plants commenced as soon as any could be seen above the surface of the ground, and was continued at short intervals until it was evident that no more seeds were likely to germinate.

With regard to the opinion, which appears to have gained currency in Victoria, that seeds which have been treated with formalin rot quickly in the ground if it be not moist enough for their immediate germination, this experiment can afford no information, as the soil was moist at time of planting, and the weather following was favourable for immediate and rapid germination. It is proposed to attend to this point in future experiments.

In Table I will be found a list of the varieties, with details of the number of seeds planted, and the actual number of plants which appeared above the ground at the times stated.

TABLE I.—Showing the number of seeds planted after treatment with the different fungicides,

Plot No.	Name of Variety.	Elliott Bros.' ("Scherings") Formalin, 1 : 320.						Elliott Bros.' ("Scherings") Formalin, 1 : 400.						Hordern's Formalin, 1 : 320.					
		No. of seeds planted.	No. of seeds germinated.					No. of seeds planted.	No of seeds germinated.					No. of seeds planted.	No. of seeds germinated.				
		15/8/05.	30/8/05.	2/9/05.	7/9/05.	11/9/05.	18/9/05.	15/8/05.	30/8/05.	2/9/05.	7/9/05.	11/9/05.	18/9/05.	15/8/05.	30/8/05.	2/9/05.	7/9/05.	11/9/05.	18/9/05.
A 1-9	Farmer's Friend...	150	131	137	138	138	140	150	124	128	128	128	131	150	140	143	142	142	142
A 10-18	Purple Straw	134	88	89	99	109	109	149	107	117	122	137	133	141	88	89	111	113	117
B 1-9	White Tuscan	150	110	116	119	122	122	129	79	84	95	95	96	131	95	97	104	107	112
B 10-18	Lambrigg White Lammas.	124	92	94	101	101	104	132	104	106	111	117	118	150	81	83	102	105	110
C 1-9	Nonpareil ...	150	119	123	134	140	141	150	114	116	134	134	134	150	137	138	141	144	144
C 10-18	Sussex........... .. .	146	86	94	113	120	120	143	114	121	125	132	133	136	99	101	110	111	114
D 1-9	Cleveland	148	14	16	68	105	111	143	39	42	75	96	98	147	33	34	74	113	121
D 10-18	Tarragon	150	29	29	76	110	122	150	72	79	104	138	138	150	49	53	101	119	123
E 1-9	Jonathan No. 1 .	150	78	84	120	135	138	150	76	82	131	137	137	150	104	104	125	128	140
E 10-18	Lazar	150	43	55	93	105	115	150	67	80	95	129	129	150	55	58	96	111	119
F 1-9	Plover	150	46	66	86	106	115	149	44	47	94	110	114	150	55	60	84	115	120
F 10-18	Haynes's Blue Stem.	150	32	34	59	113	124	150	66	74	92	136	136	148	54	56	100	115	122
G 1-9	Gilgandra x Lat x Jonathan.	146	39	40	58	66	75	126	33	35	48	57	64	138	42	43	64	64	70
G 10-18	Improved Fife ..	150	44	48	81	96	108	150	70	84	95	112	116	150	45	44	72	87	91
H 1-9	14 x Eden ..	150	123	127	131	135	137	150	136	138	148	146	147	150	134	140	125	142	142
H 10-18	(14 x 193) x Berlong	150	95	100	119	118	124	145	125	129	129	135	134	150	90	98	110	114	122
J 1-9	(D'Arblay's x 14) x Jon.	149	132	135	140	143	143	149	139	134	143	142	142	150	117	122	143	143	145
J 10-18	Browick Red .. .	150	39	49	74	82	86	148	83	112	120	121	125	150	96	103	110	109	114
K 1-9	Saratow	139	96	100	104	104	107	150	117	121	124	125	125	147	88	92	110	106	110
K 10-18	Kirkov	150	93	100	115	116	118	150	116	125	124	130	131	150	101	113	120	126	127
A 19 to J 19	Beloglino	150	39	48	58	67	72	150	55	58	74	78	81	150	54	67	78	83	83
	Totals	3076	1568	1684	2088	2337	2431	3063	1880	2012	2319	2535	2562	3088	1757	1838	2222	2407	2488
Average percentages of total germinations on dates given.		..	64·5	76·0	86·0	96·1	100	..	73·4	78·5	90·5	99·0	100	...	70·6	73·9	93·1	96·7	100
Average percentages of germinations of seeds sown on dates given.		...	51·0	54·7	67·9	76·0	79·0	...	61·4	65·7	75·7	82·8	83·6	...	57·0	59·5	72·0	78·0	80·6

and also the number of seeds which had germinated at stated periods during the trial.

Hordern's Formalin, 1 : 400.						Untreated.						Blue-stone Solution, 1 : 50.						Blue-stone Solution, 1 : 50. Seeds afterwards dipped in lime water.					
No. of seeds planted.	No. of seeds germinated.					No. of seeds planted.	No. of seeds germinated.					No. of seeds planted.	No. of seeds germinated.					No. of seeds planted.	No. of seeds germinated.				
15/8/05.	30/8/05.	2/9/05.	7/9/05.	11/9/05.	18/9/05.	15/8/05.	30/8/05.	2/9/05.	7/9/05.	11/9/05.	18/9/05.	15/8/05.	30/8/05.	2/9/05.	7/9/05.	11/9/05.	18/9/05.	15/8/05.	30/8/05.	2/9/05.	7 9,05.	11/9 05.	18/9/05.
150	137	138	138	139	139	150	122	123	126	128	128	150	104	120	128	131	137	150	118	131	132	135	138
134	105	111	117	124	126	148	129	132	136	137	141	136	82	83	107	105	115	138	70	77	97	101	109
150	103	106	109	121	123	150	103	106	110	124	123	150	88	103	114	116	123	150	58	67	86	102	115
125	81	83	103	108	111	150	94	103	113	117	119	125	84	87	97	104	107	124	58	73	95	93	100
147	124	129	132	136	140	150	120	133	132	138	138	150	107	123	127	130	134	150	49	68	82	96	106
150	130	135	141	143	145	150	106	117	128	131	132	144	100	109	122	130	133	150	88	89	113	117	119
145	55	55	87	112	118	150	43	47	68	104	104	144	41	53	88	117	123	150	13	20	53	107	111
149	39	40	72	112	119	150	49	52	109	131	131	150	64	70	101	138	139	150	39	47	91	122	122
150	113	117	134	131	135	150	72	95	113	129	129	150	91	105	125	133	136	150	42	49	74	111	121
148	60	65	92	118	119	148	62	69	112	125	128	150	57	62	86	112	118	150	66	78	119	133	137
150	65	73	95	118	125	150	49	61	74	115	120	150	31	46	89	117	136	150	15	25	48	119	126
148	64	68	89	117	121	150	74	78	120	134	136	148	53	59	96	124	127	150	77	87	118	123	125
140	52	59	63	61	72	150	79	80	101	116	118	144	47	63	88	92	98	127	5	11	30	53	69
150	58	59	77	98	101	150	81	89	106	118	119	150	56	59	75	93	93	150	69	77	96	102	106
150	124	124	130	130	131	150	140	140	146	147	146	150	116	131	145	146	146	150	95	110	126	126	133
150	114	121	123	125	128	150	120	130	136	140	140	150	106	109	129	130	136	150	116	127	136	134	134
148	135	137	142	144	144	150	112	112	128	131	133	139	123	128	131	132	132	134	92	103	112	118	124
150	77	104	98	103	109	150	109	118	126	128	128	150	64	72	113	117	123	150	71	100	103	117	120
150	112	116	121	125	128	150	91	96	97	110	112	150	102	112	114	114	115	150	78	92	101	101	111
150	106	110	119	122	125	150	121	134	136	138	138	150	103	124	130	130	131	150	100	109	122	121	127
150	23	34	58	76	77	150	39	50	85	95	97	150	37	49	96	94	93	150	46	53	74	83	85
3084	1877	1984	2240	2463	2536	3146	1915	2065	2402	2636	2660	3080	1656	1867	2301	2505	2600	3073	1365	1593	2008	2314	2438
...	74·0	78·2	88·3	97·1	100	...	72·0	77·6	90·3	99·1	100	...	63·7	71·8	88·5	96·4	100	..	56·0	65·3	82·4	94·9	100
...	60·9	64·3	72·6	79·9	82·2	...	60·9	65·6	76·4	83·3	84·6	...	53·8	60·6	74·7	81·3	84·4	...	44·4	51·8	65·3	75·3	79·3

In order to facilitate the making of comparisons, Table II has been prepared. In this table the actual numbers of the seeds of each variety which germinated are expressed as percentages of the numbers of the seeds which were planted.

TABLE II.—The actual numbers of seeds which germinated, reduced to percentages for purposes of comparison.

Name of Variety.	Percentage number of Seeds which germinated when treated as under.										
	Elliott Bros. (Schering's) Formalin, 1 : 320.	Elliott Bros. (Schering's) Formalin, 1 : 400.	Hordern's Formalin, 1 : 320.	Hordern's Formalin, 1 : 400.	Untreated.	Bluestone, 1 : 50.	Bluestone, 1 : 50, dipped afterwards in lime water.	Average germinations after treatments with formalin.	Average germinations after treatments with bluestone.	Estimated percentage killed by formalin.	Estimated percentage killed by bluestone.
1. Farmer's Friend .	93·	87·	95·	92·	85·	91·	92·	91·7	91·5	−6·7	−5·5
2. Purple Straw .. .	79·	89·	83·	94·	95·	83·	79·	86·2	76·0	+8·7	+19 0
3. White Tuscan	81·	75·	86·	82·	82·	82·	77·	81·	79 5	+1·	+2·5
4. Lambrigg White Lammas	84·	89·	73·	89·	79·	86	81·	83·7	88·5	−4·7	−4·5
5. Nonpariel	94·	89·	96·	95·	92·	89·	71·	93·5	80·0	+1·5	+12·0
6. Sussex	82·	93·	84·	97·	88·	92·	79·	89·	85·5	−1·	+3·5
7. Cleveland	80·	69·	82·	81·	69·	85·	74·	78·0	79·5	−9·	+9·5
8. Tarragon	81·	89·	82·	8)·	87·	93·	81	. 83·0	87·	+4·	0·
9. Jonathan, No. 1.. ..	92	91·	93·	90·	86·	91·	81·	91 5	86·0	−5·5	0.
10. Lazar	77·	86·	79·	80·	87·	79·	91·	80·5	85·0	+6·7	+ 2·
11. Plover	77·	77·	80·	83·	80·	91·	84·	79·2	87·5	+1·8	−7·5
12. Haynes' Blue Stem .	83·	91·	83·	82·	91·	86·	83·	84 7	84 5	+6·3	+6·5
13. (Gilgandra x L.A.T.) x Jonathan.	52·	51·	51·	52·	79·	69·	54·	51·5	61·5	+27·5	+17·5
14. Improved Fife	71·	77·	61·	67·	79·	62·	71·	69 0	66·5	+10·	+12·5
15. 14 x Edeu	91·	93·	95·	87·	97·	97·	89·	92·7	93·0	+4·3	+4·0
16. (14 x 193) x Berlong ..	83·	92·	81·	85·	93·	91·	89·	85·2	90·0	+7·8	+3·0
17. (D'Arblay's x 14) x Jonathan.	96·	95·	97·	97·	89·	95·	93·	96·2	94·0	−7·4	−5·0
18. Browick Red	57·	84·	76·	73·	85·	82·	80·	67·5	81·0	+17·5	+4·0
19. Saratow	77·	83·	75·	85·	75·	77·	74·	80 0	75·0	−5·0	−5·0
20. Kirkov	79·	87·	85·	83·	92·	87·	85·	83·5	86·0	+8·5	+6·0
21. Beloglino	48·	54·	56·	51·	65·	65·	57·	52·2	61·0	+12·8	+4·0
Average of 21 varieties...	79·	84·	81·	82·	85·	84·	79·	81·	81·	+3·7	+3·7
Average killed	6	1	4	3	..	1	6				
	3·5					3·5					

Only two brands of formalin were found to be available—one of Schering's, from Elliott Bros., and another from Messrs. A. Hordern and Sons, a third from Melbourne having arrived too late to be made use of. Two strengths, viz., 1 : 320 and 1 : 400 (1 lb. formalin to 32 gallons and 40 gallons of water respectively) were used, and solutions of these strengths were used for each sample. In both cases the solutions of the same strength gave practically the same results, the proportions of seeds which were killed by immersions of five minutes being, in the case of the formalin from Elliott Bros., 6 per cent., and 4 per cent. in that from Hordern's. When the solutions of 1 : 400 were used, the results were 1 per cent. and 3 per cent. respectively. These results, even if allowance be made for the seeds of low vitality which were not taken from the untreated seeds before they were planted, are sufficient to show satisfactorily that a 1 : 320 solution of formalin is not too strong (although stronger than is necessary or desirable) for practical use; and, as experiments made at

Lambrigg in 1901 showed that a solution of 1 : 480 was strong enough to prevent any bunt when infected seed of the three exceedingly bunt-liable varieties, Farmer's Friend, Purple Straw, and Allora Spring, was treated, we are in a position to dispose of the assertion of a Victorian farmer-experimentalist that there is little or no margin between solutions which are too weak to kill the spores of bunt, or too strong for wheat seeds which are treated not to be injured. The proportion of seeds which were killed by an immersion of the same length in a 1 : 50 solution of bluestone (and this strength, although probably unnecessarily great, is in common use) is intermediate between those which were given by the two strengths of formalin.

Some experiments, on a small scale, recently made in South Australia, seem to indicate that treatment with formalin causes seed grain to lose its vitality rather rapidly. If this be so, it will partly explain the unsatisfactory germination which has followed the planting of formalin-treated seed in dry soil, and what grounds there were for the opinion which is now current in Victoria.

With bluestone, on the other hand, the opinion has gained ground amongst farmers that the effect of treating grain with bluestone has rather a preservative effect upon it, in that it prevents the grain from rotting, as untreated grain often rots when it is planted in dry soil which continues to be dry for long afterwards.

This opinion is undoubtedly correct, for the film of bluestone which is left on seeds after they have been treated with solutions of this substance is likely to have a preservative effect on them. As this may be a point of far-reaching importance, it will be as well to devote a few lines to it:—
(1) That the spores of the fungus bunt do germinate in soils which are too dry for the germination of wheat seeds, is shown indirectly by the fact that if bunt-infected seeds be sown in such soils, the proportion of plants which are found to be bunty is very much smaller than would have been the case if the soil had been moist. The accepted explanation of this is that the bunt spores germinate because the wheat seeds have not germinated, and perish for want of a host to attach themselves to. (2) That the film of bluestone, which is left on a wheat seed after it has been treated with this fungicide, is likely to protect the grain from infection, is indicated by an experiment which was made at Lambrigg, in the year 1900. In that year two sets of bunt-infected seeds of the variety Minnesota Blue Stem were planted on 3rd August. That date, as the records show, was about the middle of a spell of dry weather, the last fall of rain of any consequence having occurred on the 5th of the previous month, and the next coming when the seed had been in the ground for a fortnight. One of the two sets of seed had received no treatment whatever before it was infected, while the other had been soaked for five minutes in a 1 to 40 solution of bluestone and dried. The two sets of seed were planted on the same day, and in adjacent drills. The result of this experiment was that the drill which was planted with the untreated seed contained nine times as many bunty plants as did that for

which the seed had previously been treated with bluestone. A single experiment in agricultural matters can seldom be considered to be enough to determine conclusively what is the direct result of any step that is taken, or the positive cause of anything that happens, and as, for this reason, we cannot be satisfied to regard this experiment as final, check experiments on a larger scale are being made to test this point. If these experiments confirm the former, and a film of bluestone on wheat seeds is found to be competent, when they are planted in dry soil, to protect from infection by bunt the plans they produce, it is difficult to see why it should not be competent also to protect the seeds from being preyed upon and killed by moulds, the spores or seeds of which may be expected to, and apparently actually do, germinate under as dry conditions as do those of bunt. This, at any rate, is what we at present think does actually occur when wheat seeds which have been treated with bluestone are planted in dry soil. It is possible that the death of seeds which have been treated with formalin, and planted in soil which is too dry for them to germinate at once, is not altogether due to the action of the formalin, but may, in part, be caused by the absence of a film to protect them from moulds, like that which treatment with bluestone leaves on them. This subject would scarcely have deserved so full a discussion had it not been that it may be so important in other respects; for if treating wheat seeds with bluestone be competent to protect them from destruction by moulds in dry soils, this expedient ought to be worthy of adoption in dry districts for the preservation of the seeds themselves, independently of the destruction of the bunt spores that may be on them; and, going a step further, if this practice be found to be good for the seeds of wheat, there is apparently no reason why it should not be useful for securing the germination of other sorts of seeds in arid districts.

In this matter we have a subject which may prove to be of great importance to dry-country farming. If the soil be moist when the seeds are planted, the film of bluestone on the seed will be dissolved and diffuse into the adjacent moisture, and be useless for protecting the seeds from moulds; but under these conditions its protection will not be needed.

With regard to the relative effects of formalin and bluestone on the vitality of the seeds, these experiments appear to indicate that some varieties of wheat are less able to endure either the one or the other or both of these fungicides than is the case with others. The varieties which suffered most from formalin in these experiments are Nos. 13, 18, 21, and 14, and bluestone was hardest on Nos. 2, 13, 14, and 5. Both of these fungicides were hard on Nos. 2, 13, and 14, of which the percentages killed averaged 14·8, 22·5, and 11·2 respectively. The discussion of this point, however, is made to be unsatisfactory by the uncertainty whether the germinations which were secured from the untreated seed of the several varieties represent sufficiently correct averages.

It will be noticed that the treatment with lime-water after bluestone had rather an injurious effect on the germination, and that the seeds

treated with formalin germinated, on the whole, somewhat more quickly than did the bluestone-treated.

Reverting to the formalin fiasco in Victoria, we have no doubt that it was caused mainly by the use of formalin in too strong solutions. In our experiments, a solution of 1 : 320 killed, on an average, 5 per cent. of the seeds treated, as compared with 1·9 per cent. by a 1 : 400 solution. As so weak a solution as 1 : 480 was found in an experiment already mentioned to be quite efficient for killing bunt-spores, it is evident that 1 : 320 is not only unnecessarily but undesirably strong, and that, therefore, 1 : 225 (the strength which is said to be recommended by Prof. Damfield) is much more so. In fact, in an experiment which was made at Lambrigg in 1899, an immersion of only three minutes in a solution of 1 : 207, which is not much stronger than 1 : 225, was found to kill 45¾ per cent. of the seeds of Allora Spring.

These preliminary experiments indicate that—

(1) Formalin does not exercise an injurious effect upon the vitality of seed grain if it be treated just prior to planting, and the conditions at planting time are favourable for its germination.

(2) There is a considerable margin between solutions which are too weak to kill the spores of bunt and those which are strong enough to seriously injure the seed grain.

(3) It is undesirable (and, previous experiments at Lambrigg prove, unnecessary) to treat seed wheat with a stronger solution of formalin than that made by mixing 1 lb. of formalin with 40 gallons (400 lb.) of water.

(4) Some varieties appear to be more sensitive to the injurious effects of fungicides than others.

Use of Phosphorus as a Poison and its possible relationship to Bush Fires.

Report by Mr. F. B. Guthrie.

With reference to the use of phosphorus as a poison and its possible relationship to bush-fires, the question of the possibility of the spontaneous ignition of phosphorus baits is one on which it is very difficult to express a decided opinion or to obtain satisfactory evidence. It cannot be said that it is impossible for such a thing to happen; but, in my opinion, it is unlikely, even when the bait is not prepared with great care, and extremely unlikely if the bait is properly prepared.

I have made a great number of inquiries among stock-owners who have been in the habit of using these baits, and have never heard of a single authenticated instance of fires having originated from this cause, and I think it may be safely said that no properly authenticated instance has yet been brought forward in which the origin of a bush-fire has been traced to the spontaneous ignition of phosphorus baits.

Absolute proof of such origin is admittedly difficult to obtain; at the same time, the cause of the outbreak of bush-fires has been frequently traced beyond dispute to some other cause, but never, as far as I can ascertain, to the use of phosphorus bait. I consider, therefore, that I am justified in stating it, as my opinion, that properly-prepared phosphorus bait (that is, bait in which the phosphorus is thoroughly incorporated) is extremely unlikely to ignite spontaneously, and thus to cause bush-fires.

The only evidence I am able to adduce from actual experience is afforded by some experiments which I carried out in the summer of 1903, for the purpose of advising as to the best method of preparing these baits. A considerable number of baits was prepared accordingly, to different formulæ prescribed by the Departments of Agriculture and of Stock in New Zealand, Victoria, and New South Wales. These baits were exposed in the open air for a considerable period during the summer months in Sydney. They were laid on the surface of earth and in contact with dry hay, the object being partly to ascertain for how long a period the baits retained their poisonous property, and partly whether there was any risk of spontaneous ignition. In no single instance did they take fire. These baits were prepared with the greatest possible care, and the mixing was very thorough, indeed. There is, undoubtedly, a greater risk of the phosphorus taking fire if the mixing

has not been done so carefully; and persons inexperienced in the handling of chemicals cannot be too strongly warned against risks attending the handling of phosphorus. Machine-mixers are sold for preparing and cutting up the bait, which minimises the risks incurred by hand-mixing. It would be better to obtain bait ready prepared by a reliable firm, several of whom supply phosphorus-bait ready for distribution.

The risks attending the mixing of phosphorus with pollard, grain, &c., are considerably increased by the use of bisulphide of carbon as a solvent, which is recommended in several of the formulæ. My experience is that the use of this reagent provides no compensating advantage to justify its use.

For the preparation of phosphorised pollard, the formulæ prescribed by the Victorian Department of Agriculture was found to be the most satisfactory, there being less sparking during the preparation than by the other methods in which warm water was used, and the bait retaining free phosphorus after two weeks' exposure to the fairly hot sun of February-March, 1903.

I would strongly urge the appointment of a committee to make systematic inquiry into the whole question of the use of poison-baits. Such a committee could, in the first place, draw up a number of questions, replies to which could be asked for from stock-owners and farmers in different parts of the country; they could then take such additional evidence as they deemed desirable, and could carry out, in co-operation with owners of stock, any experiments which they might consider necessary. The committee should include representatives of the Department of Agriculture and of Stock, a gentleman conversant with pastoral matters, and a chemist, who would be able to advise on the scientific aspect of the question and conduct any experiments the committee may consider advisable.

In the meantime, I would suggest stock-owners and others using poison-baits should be notified as to the following points:—

1. The extreme danger attending the careless handling of phosphorus—firstly, from its liability to take fire whilst being handled (it should be cut under water); and, secondly, from the poisonous nature of the fumes.
2. Carbon bisulphide is an exceedingly dangerous substance to handle, the vapour being readily inflammable and extremely poisonous.
3. The use of carbon bisulphide is unnecessary, the baits being most safely and effectively prepared by melting the phosphorus under water.
4. For the preparation of phosphorised pollard, the directions given by the Victorian Department of Agriculture are the safest and best.
5. If the cost is not too great, the best plan is to obtain the baits ready-prepared from a reliable firm.
6. If made on the premises, machine-mixing is preferable to hand-mixing, both on account of economy, safety, and efficiency.

Orchard Notes.

W. J. ALLEN.

December.

As the spring has been so dry throughout the coastal district, the very best cultivation will be required in order to keep the fruit-trees and vines in good growing condition. If rain should fall, then no time must be lost in working the ground as soon as the land is dry enough to work.

The marketing of apricots, early peaches, cherries, and late loquats, early dessert pears, and cooking apples will be the principal work for this month. Such fruits as are intended for dessert purposes are best handled a little on the green side, else when they reach the town or city where they are to be offered for sale they will be overripe, in which state the dealers will not buy them, as they will not stand the repeated handlings necessary before reaching the consumer. The grower must not forget to grade all fruits and pack them neatly.

Apricot-drying will be in full swing this month wherever this fruit is grown for the purpose. Directions and particulars for drying this and other fruits are dealt with in a separate article in this number of the *Gazette*.

The earliest cherry to ripen with us this year has been the Guigné Tres Prècoce, which is growing at our Wagga Experimental Orchard, and specimens of which were ripe enough to eat on the 6th November. It is a medium-sized red cherry, with pink flesh, rather tender for carrying well, but owing to its being the earliest on the market it usually commands a high price.

All orchard land should be kept free from weeds, and to accomplish this the horses and cultivators will have but little rest this month, as an orchard neglected for a few days will soon be covered with a coating of summer grass which will take many a hard day's work to eradicate, and couch grass spreads rapidly when left undisturbed. Where there are bad patches of couch grass, these should be ploughed up and harrowed on a very hot day, as the roots soon die when exposed to the sun.

Passion vines which have been properly pruned and manured during November will now be putting on good growth and blooming freely. This fruit will be ready to meet the demand at Easter, when it usually finds a ready sale at good prices.

Keep a strict outlook for pests, and if trees have not been fumigated or sprayed, as the case may be, the grower should lose no time before beginning to fight them.

For scales on citrus trees, December, January, and February are good months for either spraying or fumigating; but for fungus diseases it is

generally best to spray once before the trees bloom; again as soon as the fruit has set, rather than leaving it until now. In many cases, however, later sprayings are both beneficial and necessary.

The grower should not neglect to either fumigate or spray all citrus trees, so as to ensure clean fruit and healthy trees.

Keep a strict watch over all bandages placed on apple, pear, and quince trees. They should be overhauled and all larvæ destroyed at least every ten days; also pick up and destroy all fallen fruit.

If fruit-fly should make its appearance, all infested fruit should be destroyed, so as to assist, as far as possible, in keeping this pest in check.

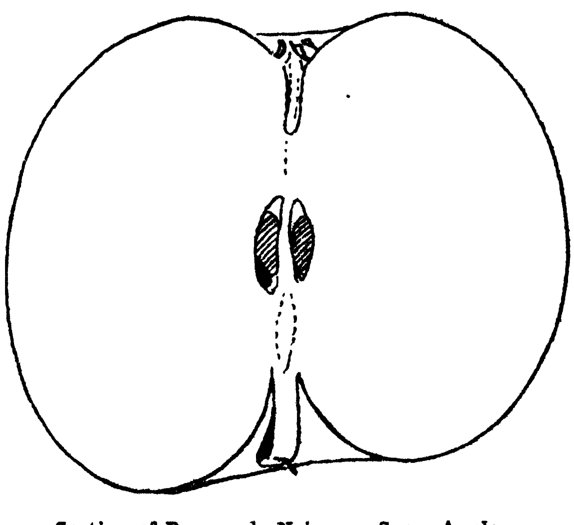
In tropical districts pine-apples may be planted if moist weather prevails. Suckers are the best to plant, being much the stronger and earliest to arrive at maturity. Being great feeders, a dressing of strong nitrogenous fertilizer will promote rapid growth and fine fruit. While the plants are young, cultivation must be thorough, but not deep enough to cut the feeding roots which are near the surface.

Banana and other tropical fruits may also be planted during the rainy season.

COLOURED PLATE.

Fameuse (Pomme de Neige, Snow, erroneously called "Fanny" at times).

This variety is supposed to have originated in Canada. Medium size, round, and often oblate, even. When well coloured, as when grown in our lighter soils, it becomes handsomely striped and blotched with deep crimson or deep red, nearly concealing a pale yellow to whitish ground. Flesh snowy white, tender, juicy, subacid, a little spicy; stalk slender, one half to three-quarters of an inch long, in narrow funnel-shaped cavity. Calyx small, in shallow, rather narrow basin. Autumn apple. One of the finest dessert apples, and is usually much admired for its handsome appearance and pleasant, refreshing flavour. Tree vigorous, shoots dark, diverging. Rather subject to black spot when grown in very moist districts. Is one of the most profitable autumn dessert apples to grow, finding ready sale on the Sydney market under the name of "Fanny."



Section of Pomme de Neige, or Snow Apple.

Farm Notes.

HAWKESBURY DISTRICT—DECEMBER.

H. W. POTTS.

NOVEMBER of 1905 will be long remembered as one of the most trying ever experienced by the farmers on the Hawkesbury. The bleak westerly winds of the winter continued with the rise of temperature in spring. On the 1st November we had a frost, which destroyed potatoes, young maize, melons, pumpkins, and other young plants. On the 8th November, accompanied by westerly gales, the heat rose to 102 degrees F. in the shade, and the crops which escaped the frost succumbed to the extreme heat a week later.

Bush fires are ablaze on all sides, and the utmost precautions have to be observed to check outbreaks.

The hay crops this year have not been a failure altogether, and whilst the bulk of the oat crops were short, the wheat hay returns were, as a rule, satisfactory. The quality in each case is good, as also is the colour. Few farmers will have grain crops to harvest this month; in fact, with such a shortage of feed all round, most farmers have converted them into hay.

Mr. Musson's weather returns prove that we have had a lower rainfall than the worst year of the big drought. To this add the severity of the season, with its frequent frosts and continuous westerly winds.

Maize.—In many cases the maize crops will require to be resown this month. Every opportunity must be taken to keep the soil surface well cultivated, to aerate it, keep the growth of weeds down, and form an earth mulch to check evaporation and conserve soil moisture. This is more essential after rain. Shallow cultivation is found most serviceable; the stirring of the soil below 3 inches is liable to interfere with root growth by severing tender rootlets and establishing a form of root pruning, which does not effect any gain. The success of the crops depends largely on the treatment of the young plant, and to this end constant shallow, fine cultivation is an important factor. Sowing may be continued up to Christmas. This year we will have to depend mainly on the late crops, and where the ground is in a thorough state of cultivation and friable, with sufficient moisture, the germination will be free. The varieties may be selected from the following:—Pride of the North, Early Mastodon, Hickory King, Red Hogan, Golden Beauty, Hawkesbury Champion, and Riley's Favourite. Where the soils are light and have not been previously fertilised by catch crops, being fed off with stock, the following manure can be used to advantage:—Two parts bonedust with one part No. 1 superphosphate: 1½ cwt. to each acre.

Sorghums.—The experience of last season is being repeated, and we fully realise how the sorghum crops provided us with such excellent fodder all last winter, and gave us food-material to fill our silo pits and tubs, and build ensilage stacks. The soil may be got ready for this crop at once. Plough deeply the first time, *i.e.*, about 8 inches, harrow, roll, and plough again, until a fine tilth is secured. Where required, the manure recommended for maize may be used. The varieties found to be suited to our conditions are Early Amber, Planter's Friend, and Sorghum Saccharatum. Sow 7 lb. to 10 lb. to the acre.

Millets.—These may be sown this month, and will afford a prolific growth for green feed before the early frosts set in.

Cowpeas.—These are, as a matter of fact, beans, not peas, and belong to the same family of plants that provide us with lima, haricot, and other garden beans. We have experimented during the past seven years with a large number of varieties to arrive at some definite data in selecting those most likely to provide us with a suitable fodder during the heat of summer. The value of the cowpea as a fodder is augmented through its known properties in restoring fertility. We are realising its value now in the rotation of farm crops. It flourishes at a period when other crops are useless as a soil renovator, and is thus particularly useful in warm climates. It is now known that during its period of growth it possesses the special function of gathering nitrogen from the atmosphere, and thus increases the sum of available plant food in the soil. When turned in, the plant provides humus, so essential in dry soils, not only for increasing its organic contents, but also to increase the moisture-holding capacity of a soil. Amongst the leguminous crops, cowpeas stand very prominent during our summer months, in providing succulent fodder as well as nourishing the soil. Cowpeas thrive on light sandy soils, where other plants would starve. In the rotation, it may follow cereals, and when eaten off with sheep or pigs will give a return providing a good profit on the cost of seed and cultivation, with the additional advantage of leaving the soil in good condition to be followed by an exhaustive crop. The crop may be eaten off by stock, converted into hay, or preserved as ensilage; being a highly nitrogenous food it ranks with lucerne, bran, and clover in the production of red flesh and the solids in milk. The mode of culture is to give the soil thorough tillage, getting the surface into a fine condition. Plant the cowpeas in drills 3 feet apart, with the seeds 6 to 8 inches from each other. Use 7 lb. to 10 lb. of seed per acre, according to the variety. We use an ordinary maize drill, fitted with a plate having ⅜-inch holes. After planting, when the peas just appear above the ground, a scuffle should be sent along the drills once a fortnight to keep the soil clean and loose. This is necessary until the vines grow too dense.

Where the soil is deficient in lime, it will be advisable to use about ½ ton of gypsum to the acre three months prior to the final cultivation. A dressing of superphosphate, at the rate of 1½ to 3 cwt. per acre, is

useful. The following varieties were tested here during a very dry season; the results were:—

White	9 tons	8 cwt.	per acre.
Warren's Extra Early	8 ,,	9 ,,	,,
Warren's New Hybrid	8 ,,	1 ,,	,,

Whip-poor-Will, Iron, Clay-coloured, and the Black also provide good crops.

Potatoes.—The potato crop this season has not been successful, owing to the vagaries of the climate. Subsoil moisture is low, and the late frosts checked growth. The crops will require a good deal of attention for cleaning purposes, as well as to encourage growth.

Sweet Potatoes.—The main crop may be planted out this month, after the ground has been well cultivated. Where the soils are light, it is well to follow a good catch crop turned in. These useful plants need considerable organic matter for rapid propagation, and where farm-yard manure is obtainable it gives the best results. The best varieties are Jersey Red, White Maltese, Pink, Big Stem Jersey Yellow, Pierson, and Short Stem Jersey Yellow.

Soy Bean.—The Early Yellow, sown ½ to 1 bushel per acre, seems to respond best in this district. This plant owns similar qualifications to cowpeas, in that it is a legume, and is useful for forage as well as a soil renovator. It is a summer fodder, and requires similar treatment in point of soil and cultivation to cow-peas.

Pumpkins, Melons, Squashes.—Those plants which escaped the late frosts will need cultivation at regular periods during the dry weather to stimulate a vigorous growth. Further sowings may be made this month. It is advisable to put in a full quantity for feed for pigs and cattle during the summer months. They afford a relishable change of diet.

Clarence River District.—December.

T. WALDEN HANMER.

After receiving useful showers of rain in the middle of October, we returned to most unseasonably cold, dry windy weather, which lasted until early in November, when for a few days we got a mild heat wave, the thermometer registering 106 degrees Fahr. in the shade on King's Birthday.

Maize.—In some parts of this district, maize only about 2 ft. 6 in. high is out in tassel. Sowings of maize should be completed by the end of this month, unless it is required for green fodder, although January sowings for grain often turn out well.

Amber Cane, Imphee, and Planter's Friend may be sown for green fodder this month, also Buckwheat and Hungarian millet. Broom millet may also be sown, the White Italian variety being considered the

best by most growers. That already sown will possibly require to be thinned out. Keep the land thoroughly cultivated between the rows as long as possible without injuring the plants.

Cultivate the land between the rows of sweet potatoes, and do not allow the vines to meet or root if large size tubers are desired. The land should be got ready by ploughing, &c., for potatoes, turnips, beet, &c.

The only vegetable likely to do well in this part of the State at this season of the year is French bean, but this will not do if the weather be dry. Plough up all land as soon as possible after the crops are taken off.

Pumpkins, *melons*, *grammas*, may be planted, and those already growing will benefit very much by mulching, where possible.

Glen Innes District.—December.

R. H. Gennys.

Potatoes, for the main crop, may be sown this month.

Sorghums for green feed.—Amber Cane and Planter's Friend are two good varieties to grow.

Millets, also for green fodder.—Orange and Pearl millet will both do well here. Hungarian is a good hay-millet.

Haymaking will be in full swing this month. For oats, the time to cut is when the tops of the heads are commencing to whiten; if made into sheaves, care should be taken that the inside is not too sappy when stacked, or heating is likely to take place, and a large portion of stack may be destroyed.

Wheat for hay should be cut in the flowering stage; it will then be more nutritious, have a good colour, which is everything in marketing, and whether used as rack-hay or cut into chaff, is in every way better than if grain be left till partially or wholly matured.

Harvesting Wheat for Grain.—Here the reaper and binder is generally used, nor do I think the stripper is likely to take its place. Those varieties that hold their grain well should be allowed to get well ripe; but there are some that are liable to shell, and must be cut on the green side, or much grain will be lost. Some of the wheats that are apt to shell, and should be cut on the green side, are Power's Fife (Manitoba), Lambrigg White Lammas, White Hogan, Cumberland, and Bobs. Amongst those that hold grain fairly well are Tarragon, Tardent's Blue, Zealand, Field Marshal, John Brown, and Sussex. Those that hold grain, among the best are—Jonathan, Federation, Nonpareil. Of these, Jonathan holds its grain the best of all; but, in consequence, is somewhat hard to thresh. Those wheats that are cut on the green side, of course, should be allowed to stand longer in the field before being carted to the stack.

Riverina District—December.

G. M. McKEOWN.

Stack Ensilage.

It is of the greatest importance that the base of a stack shall be of right dimensions, so as to ensure the least possible amount of surface exposure and the exercise of the greatest possible pressure on the lower part of the stack by the upper portion of the material. It is inadvisable to build small stacks, owing to the greater waste, consequent on the larger surface exposure in proportion to the quantity of material. A stack to contain 25 tons should be the least size that should be attempted, and where only this quantity of fodder is available, it will be found preferable to use a pit or a disused room or building, if such is available, as in the latter case even a much less quantity may be conserved. The base of a 25-ton stack should be about 10 x 10 feet. About 45 cubic feet of good silage will make a ton. Stacks to contain from 50 tons upwards will be found preferable, owing to the lower proportionate waste, and the larger they can be conveniently built the better. A base of 14 feet square will carry 50 to 60 tons, and 18 feet square will carry 120 tons, and so on in proportion, if not built too rapidly. It is preferable to allow intervals for settlement, as by thus allowing time the stack may be more compactly built and the lift may be considerably reduced. Where a large quantity of material is available, the erection of two or more stacks may be proceeded with alternately, and thus no time need be lost. A well-drained site should be selected, and, if necessary, it should be levelled to ensure a secure base. The ground should be covered with timber or a good bed of straw, to prevent moisture rising from the soil, and all surface water should be cut off.

The best time to commence to cut grass and other natural herbage is when in flower, and cutting may be continued as long as the crop is in a succulent condition.

Wheat, barley, vetches, and peas should be in a similar stage of growth in the drier districts, while in coastal or other moist localities they may safely be cut in a more advanced condition, as in the latter places the fodder is likely to contain more moisture than is usual under the former conditions, and they do not dry off so rapidly. In dry districts it will be found advisable also to cut sorghum and maize at an earlier stage of growth than is usual on the coast, and to use pits or buildings in preference to stacks, as the comparative dryness of the fodder causes greater loss in stacks than that which occurs in the case of fodder plants of finer texture, which admit of more compact stacking than is possible with those of coarser growth.

The chaffing of maize and sorghum is recommended, and therefore their conservation in a walled receptacle is necessary to secure the best results in quantity and quality of silage. The material should be spread evenly, and if cut with reaper and binder the bands should be cut and

drawn, so as to admit of more compact building and the more effectual exclusion of air. If the bands are left intact, there are liable to be considerable spaces between the sheaves if they are of full size. The butts of the sheaves should be placed outwards, each row binding the next, and the material should be well trodden from the start. Special attention should be paid to the sides and corners, so that they may be as compact as possible. The sides should be kept plumb, and the corners may be rounded off. The surface of the stack should be kept quite level while in course of erection, as if the middle be raised the material when saturated with moisture has a tendency to slip outwards; and an outward slip is much worse than an inward one, as it is difficult to remedy.

At the close of each day's work it is advisable to apply some pressure to assist in consolidating the material, and some heavy timbers of good length will be found very useful for the purpose. The weights should be removed on resuming work, but at the completion of the stack they should be allowed to remain on top. If a stack is well trodden while in course of erection comparatively little pressure will be required, 3 or 4 tons being sufficient to compress the upper portion, which in its turn provides pressure for the lower part. Should it be desired to take the temperature, a piece of metal pipe should be built into the stack, so as to admit of a thermometer being suspended by means of a flexible wire, fairly in the middle of the stack. The thermometer can then be withdrawn when it is desired to ascertain the temperature. Fermentation commences at 90 degrees F., and as it is undesirable that the temperature should rise above 150 degrees F., more pressure should be applied should it appear likely that the limit will be exceeded.

The stack when built to the required height may be rounded on top and well covered with straw, so placed as to throw off the wet, or it may be covered with galvanized iron or roofing felt. The more permanent roofing is to be preferred in districts liable to heavy rain.

A stack may be opened and fed out in eight to twelve weeks after completion, but sufficient fodder only for the day's supply should be removed. A hay knife should be used, and as little of the stack as possible exposed, the face thus opened being covered with straw or with a tarpaulin.

In free soils, or in the sandhills, which latter are frequently met with in parts of Riverina, pits for ensilage may be economically excavated by means of plough and scoop, as used for tank sinking.

The material used for fodder may be trodden by the teams engaged in filling the pits, by driving them in at one end and out at the other, and the earth which has been removed may be used as cover for the fodder, which may be raised above the ground level if so desired.

All surface water should be cut off.

Crown Lands of New South Wales.

The following areas will be available for selection on and after the dates mentioned:—

H.S. or S.L. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
			For Homestead Selection.					
			acres.		acres.		£ s. d.	1905.
*990	Coonabarabran	....	264	2	130½ and 133½	Coonabarabran, 2; Gunnedah, 66	2 9 0 and 2 10 2	7 Dec.
*991	Metropolitan	....	49 a. 1 r. 30 p.	2	24 a. 1 r. 30 p. and 25 a.	Hurstville, 8	0 6 2 and 0 6 4	7 „
								1906.
*992	Narrandera	Narrandera and Grong Grong.	....	1	488⅓	Grong Grong, 3; Narrandera, 11.	10 13 9	11 Jan
			For Settlement Lease.					
			acres.		acres.		£ s. d.	1905.
*819	Warialda	Waliangra	18,410	5	2,800 to 5,190	Warialda, 31 to 40; Warialda Railway Station, 35 to 44.	38 18 9 to 58 12 0	7 Dec.
*821	Armidale ..	Enmore .. .	.....	1	1,230	Armidale, 17; Uralla, 17.	15 7 6	21 „

For Improvement Lease.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block	Date of Sale or Tender.
			Central Division.					
			acres.		acres.		£ s. d.	Tender. 1905.
1355 1356	Wyalong and Condobolin	Lake Cowal.	5,500	2	400 and 5,100	Wyalong, 32	1 13 4 and 21 5 0 (Including rent for Crown improvements.)	11 Dec.

For Conditional Purchase.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		a. r. p.			£ s. d.	1905.
Albury .	....	220 0 0	Cumboroona ..	Goulburn ..	0 15 0	28 Dec.
						1906.
*Armidale ..	Serpentine River..	330 0 0	Serpentine . ..	Clarke ..	1 0 0	25 Jan.
Barmedman .	Mimosa (partly) .	173 0 0	Trickett .. .	Bourke ..	1 0 0	4 „
						1905.
„ ..	Lower Methul Creek	927 2 0	Yarranjerry ..	„ ..	0 13 4	14 Dec.
						1906.
Bathurst ..	....	47 1 0	Three Brothers ..	Bathurst ..	1 0 0	25 Jan.
						1905.
„ ..	....	7,099 0 10	Malmsbury, Vittoria, Cadogan, &c.	„	0 8 4 to 0 15 0	28 Dec.
„ ..	....	535 0 0	Oakley	„ ..	0 8 4	28 „
„ .	....	65 0 0	„ .. .	„ ..	1 0 0	28 „
Bombala ..	Bibbenluke (partly)	1,800 0 0	Creemah and Wellsmore.	Wellesley ..	0 10 0	28 „

* For original holdings only.

For Conditional Purchase—*continued.*

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available
		a. r. p.			£ s. d.	
Casino ..	....	160 0 0	Tatham .	Richmond .	1 10 0	1906. 11 Jan.
‡*Condobolin ..	....	330 3 30	Condoublin .	Cunning-ham.	2 0 0 to 2 10 0	1905. 14 Dec.
*Coonabarabran	Ulinda	210 0 0	Bungabah . ..	Napier	1 0 0	14 „
„ ..	....	6,405 0 0	Yarragrin, Clungra, and Bandulla.	Gowen	0 12 6 to 1 3 4	1906. 11 Jan.
* „ .	....	131 0 0	Coonabarabran .	„ .	1 5 0	1905. 14 Dec.
„ ..	Caigan	160 0 0	Greenbah .	Gowen	1 0 0	28 „
Cootamundra	....	819 1 0	Walladilly .	Bland ..	0 15 0	28 „
*Dubbo ..	Bundemar and Berida.	4,000 0 0	Bugabada, Bundi-joe, &c.	Ewenmar .	1 10 0	14 „
Eden	....	280 0 0	Bondi . .	Auckland ..	0 10 0	7 „
*Grafton ..	Resumed Areas 753 and 833.	1,555 0 0	Richmond and Ashby.	Clarence	0 15 0	14 „
„ ..	....	370 0 0	Bagawa	Fitzroy .	1 0 0	1906. 18 Jan.
Gundagai ..	Bangus and Ade-long.	140 0 0	Euadera .. .	Wynyard	0 10 0	1905. 14 Dec
„ ..	Yabtree and Mount Adra.	50 0 0	Yaven .. .	„ ..	0 15 0	14 „
*Gunnedah .	....	500 2 0	Melville .	Pottinger .	1 13 4	28 „
Inverell .	Laura .. .	155 0 0	Laura .. .	Hardinge	1 0 0	1906. 4 Jan.
Lismore	.. ..	98 3 0	Broadwater	Rous	1 5 0	18 „
Lithgow .	....	860 0 0	Cox .. .	Cook . .	0 8 4	18 „
†Mudgee ..	....	700 0 0	Avisford .. .	Wellington	1 3 4	1905. 7 Dec.
„ .	....	163 1 0	Coogal ..	Phillip	0 10 0	1906. 18 Jan.
*Narrandera .	Boree Creek (partly)	1,260 0 0	Faithfull	Mitchell .	1 5 0	18 „
„ ..	Kooba .	353 0 6	Hulong . .	Cooper .	1 10 0	18 „
‡*Parramatta	....	46 1 0	Berowra .. .	Cumberland	3 0 0	1905. 7 Dec
Queanbeyan ..	. ...	640 0 0	Naas .. .	Cowley ..	1 0 0	1906. 18 Jan.
Tamworth .	Barraba, detached	6,800 0 0	Ironbark and Bun darra.	Darling ..	0 8 4	1905. 7 Dec.
„ ..	„ „ ..	5,400 0 0	Ironbark and Bun-darra	„	0 15 0	7 „
* „ .	North Barraba .	630 0 0	North Barraba	„ .	1 5 0	1906. 25 Jan.
Taree ..	....	1,000 0 0	Teleraree	Gloucester	1 0 0	25 „
‡Tenterfield .	.....	67 0 0	Acacia	Buller	1 0 0	1905. 7 Dec.
Tumbarumba	Glencoe Manus	359 0 0	Manus . ..	Selwyn .	0 13 4	7 „
Tumut	....	110 and 830	Selwyn and Batlow	Wynyard .	0 8 4	14 „
„ ..	....	93 3 0	Hindmarsh . .	„ .	0 10 0	28 „
Walcha	....	310 0 0	Ingleba	Vernon .	1 0 0	1906. 25 Jan.
Warialda	Wallangra . .	1,780 0 0	Wallangra and Cu-cumba.	Arrawatta	1 13 4	4 „
‡*Windsor .	....	1,073 3 20	Pitt Town .	Cumberland	2 0 0 to 3 0 0	1905. 7 Dec.
„ .	....	2,638 0 0	Tollagong ..	Hunter	0 10 0	7 „
Young	.. . .	295 0 0	Milong	Bland	2 0 0	28 „

* For original holdings only.
† In lieu of notification in previous issue, setting the land apart for original conditional purchase only.
‡ Also set apart as special area.

Special Area.

Condobolin Land District, within Condobolin Population Area, 330 acres 3 roods 30 perches, in parish Condoublin, county Cunningham; maximum area, 81 acres 3 roods; minimum area, 19 acres 3 roods 10 perches; price, £2 to £2 10s. per acre. Available for original applications only on 14th December, 1905.

Parramatta Land District, within the suburban boundaries of Maroota, 46¼ acres; maximum area, 16 acres 2 roods 20 perches; minimum area, 13 acres 2 roods 30 perches, price, £3 per acre. Available 7th December, 1905. (Original applications only.)

Windsor Land District, within Windsor and Pitt Town Population Area; 1,073 acres 3 roods 20 perches; maximum area, 58 acres 1 rood 10 perches; minimum area, 18 acres 0 roods 20 perches, price, £2 to £3 per acre. Available 7th December, 1905. (Original applications only.)

ROBERT McDONALD,
Acting Under Secretary.

AGRICULTURAL SOCIETIES' SHOWS.

1906.

Society.	Secretary.	Date.
Albion Park A., H., and I. Society	Henry Fryer	Jan. 17, 18
Gosford A. and H. Association	W. E. Kirkness	„ 26, 27
Kiama Agricultural Association	Jas. Somerville	„ 26, 27
Berry Agricultural Association	A. T. Colley	Jan. 31, Feb. 1, 2
Alstonville Agricultural Society	J. C. Foster	Feb. 7, 8
Central Cumberland A. and H. Association, Dural	H. A. Best	„ 7, 8
Moruya A. and P. Society	John Jeffery	„ 7, 8
Wollongong A., H., and I. Association (Wollongong)	J. A. Beatson	„ 8, 9, 10
Manning River A. and H. Association	S. Whitehead	„ 15, 16
Guyra P., A., and H. Association	H. W. Vincent	„ 21, 22
Lithgow A., H., and Produce Society	H. N. Jolliffe	„ 21, 22
Liverpool A., H., and A. Society	P. A. Shepherd	„ 28, Mar. 1
Gunning P., A., and H. Society	Ernest E. Morgan	Mar. 1, 2
Campbelltown A., H., and I. Society	A. R. Payten	„ 6, 7
Tenterfield Intercolonial P., A., and Mining Association	F. W. Hoskin	„ 6, 7, 8
Bega A., P., and H. Society	John Underhill	„ 7, 8
Walcha P. and A. Association	S. Hargrave	„ 7, 8
Macleay A., H., and I. Association	E. Weeks	„ 7, 8, 9
Fair days	....	„ 9, 10
Nepean District A., H., and I. Society, Penrith	E. K. Waldron	„ 8, 9
Berrima A., H., and I. Association (Moss Vale)	James Yeo	„ 8, 9, 10
Bombala Exhibition Society	W. G. Tweedie	„ 13, 14
Cumnock I., A., and H. Association	W. L. Ross	„ 14
The P. and A. Association of Central New England, Glen Innes	Geo. A. Priest	„ 13, 14, 15
Clarence P. and A. Society, Grafton	T. T. Bawden	„ 14, 15
Camden A., H., and I. Association	A. Thompson	„ 14, 15, 16
Oberon A., H., and P. Association	W. Minehan	„ 15, 16
Newcastle and District A., H., and I. Association	Owen Gilbert	„ 15, 16, 17
Lower Clarence Agricultural Society, Maclean	George Davis	„ 20, 21
Cobargo A., P., and H. Society	T. Kennedy	„ 21, 22
Gundagai P. and A. Society	A. Elworthy	„ 21, 22
Blayney A. and P. Association	H. R. Woolley	„ 21, 22
Crookwell A., P., and H. Association	C. T. Clifton	„ 22, 23
Tamworth Agricultural Association	J. R. Wood	„ 27, 28, 29
Durham A. and H. Association, Dungog	C. E. Grant	„ 28, 29
Mudgee Agricultural Society	J. M. Cox	„ 28, 29, 30
Cooma P. and A. Association	C. J. Walmsley	April 4, 5
Bathurst A., H., and P. Association	W. G. Thompson	„ 4, 5, 6
Warialda P. and H. Association	W. B. Geddes	„ 4, 5, 6
Richmond River A., H., and P. Association (Casino)	E. J. Robinson	„ 5, 6
Hunter River A. and H. Association (West Maitland)	C. J. H. King	„ 24, 25, 26, 27, 28
Orange A. and P. Association	W. Tanner	„ 25, 26, 27
Upper Manning A. and H. Association	Edw. Rye	May 3, 4
Moree P. and A. Society	S. L. Cohen	„ 9, 10
National A. and I. Association of Queensland	....	Aug. 7, 8, 9, 10, 11
Murrumbidgee P. and A.	A. F. D. White	„ 22, 23
Junee P., A., and I. Association	T. C. Humphrys	Sept. 5, 6
Young P. and A. Association	Geo. S. Whiteman	„ 12, 13
Yass P. and A. Society	W. Thomson	„ 26, 27

[2 plates.]

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[ADVERTISEMENT.]

Government Stud Bulls available for lease or for service at State Farms.

Breed.	Name of Bull.	Sire.	Dam.	District where now stationed.	Lease expires.
Shorthorn ..	Royal Duke II..	Oxford's Forest King.	Royal Duchess	Inverell	26 Apl., '06.
" ...	Dora's Boy ...	Cornish Boy ...	Lady Dora ..	Berry Stud Farm..	*
" ...	Fanny's King ...	Pansy King ...	Fanny ...	Manning River ...	29 Jan., '06.
" ...	Royalty ...	Royal Duke II..	Plush ...	Grafton Farm ...	*
Jersey ..	Melbourne ...	Woolloomooloo..	Harebell ...	Berry Stud Farm..	*
" ...	Thessalian II ...	Thessalian ...	Egyptian Princess	Seven Hills ...	— May, '06.
" ..	Colleen's Golden Lad.	Melbourne ...	Colleen ...	Wagga Exp. Farm	*
" ...	Golden Lord ...	Golden King ...	Colleen ...	Singleton	4 May, '06.
Guernsey ...	Calm Prince ..	Rose Prince ...	Gentle ...	Dapto	21 Dec., '05.
" ...	Gentle Prince ...	Rose Prince ...	Gentle ...	Grafton Farm ...	*
" ...	Sea King ...	The Admiral ..	Flaxy ...	Lismore	27 Apl., '06.
" ...	Rose Prince ...	Guess	Rose Blossom	Berry Stud Farm..	*
" ...	The Admiral ...	Hawkes Bay ...	Vivid (imp.)..	Hastings River ...	6 Aug., '06
" ...	Saucy Prince ...	Rose Prince ...	Saucy Sal ...	Tweed River .	9 Apl., '06.
" ..	Prince Milford	Rose Prince ...	Flaxy ...	Burringbar (Tweed River).	30 Apl., '06.
Red Poll ...	Dairyman ...	Dandy	Turban ...	Berry Stud Farm..	*
Ayrshire ...	Daniel	Sir Thomas ...	Craig... ...	Berry Stud Farm..	*
" ...	Don Juan ...	....	....	H.A. College, Richmond	*
Kerry... ...	Kildare.. ...	Aicme Rex ...	Kitty ...	Berry Stud Farm..	*
"	Gay Knight ...	Prince of Leinster (353).	Pansy II ...	Bathurst Exp. Farm.	*
Dexter Kerry	Waterville Punch.	....	....	Grafton Farm ..	*
" ...	Erebus	....	....	H.A. College, Richmond	*
Holstein ...	Obbe II ...	Obbe	La Shrapnel..	Camden	3 Dec., '05.

* Available for service only at the Farm where stationed.

Regulations under which the Government Stud Bulls are leased.

Department of Mines and Agriculture,
Sydney, 1st July, 1903.

1. Any Agricultural Society, Dairy Farmer, or a combination of Dairy Farmers, may, should the Minister deem it advisable, obtain the hire of one of the Government stud bulls for a period of six months if they guarantee payment for the service of thirty cows, or for shorter periods on special terms.

2. The fee, *which shall be payable in advance,* shall be at the rate of 5s. (five shillings) per cow for all bulls save Dexter-Kerries, and their fee shall be at the rate of 2s. 6d. (two shillings and sixpence) per cow. *Bulls will in no case be forwarded until the fees have been received.*

3. Bulls leased will be transferred free of charge to any place not more than 100 miles by rail from the place from which they are transferred; to any place distant more than 100 miles by rail, lease will be granted only on condition that the lessee pays all charges for the extra distance over 100 miles. In the case of bulls sent by sea, or partly by rail and partly by sea, all expense over the sum of £1 (one pound) must be borne by the lessee. The lessee must make all arrangements for, and bear all expense of, transferring a bull from the nearest railway station or port to the place where it is to be stationed. In the case of leasing a bull already stationed within the district, the new lessee must send for the bull and bear the expense of removal.

4. A condition of the leasing of the bulls shall be that the farming public be allowed to send cows to the bull at a fee of not more than 10s. (ten shillings) per cow, provided the bull's list is not already full, but the total number of cows served must not be more than thirty for six months.

5. Each bull shall be treated and kept in a condition to satisfy the Department, and shall be at all times open to inspection of authorised Officers of the Department.

6. A return showing the number of cows served, and distinguishing between cows owned by those to whom the bull is leased and the outside public, shall be sent to the Department at the end of the term.

7. All due care must be taken to see that the bull shall not have access to cows suffering from any infectious disease, special attention being given to pleuro-pneumonia and tuberculosis.

8. No farmer who is known to have pleuro-pneumonia in his herd shall be permitted to send cows to any of these bulls within three months from the date of the last outbreak.

9. In case of illness of a bull the Department shall be immediately informed.

10. The bull shall not be allowed to run with cows, but shall be kept in a special bull paddock, which must be well fenced, and each cow "in use" shall only be allowed to remain with the bull such time as will enable him to have connection with her twice. However, where necessary, in order to keep bulls quiet, special permission may be given to run with one or two specially-selected healthy cows.

11. Should any of the foregoing rules not be complied with, the Department shall have the right to remove the bulls at once, and all fees paid shall be forfeited.

12. Should a bull be wilfully neglected or badly treated, the Department shall have the right to take any action desirable for the recovery of damages.

13. All applications for bulls should be made to the Director of Agriculture, Department of Agriculture, Sydney.

AGREEMENT CLAUSE.

In consideration of the loan of one Stud Bull ( ) for a period of
I, of do hereby agree to be bound by the conditions expressed in the foregoing Regulations

Dated this day of 190 .

Witness,— *Lessee.*

J.P.

Duty Stamp.
One Shilling.

N.B.—This agreement must be signed on the day the bull is received by the lessee, and is to be returned by first post to the Director of Agriculture.

Date of issue.	Date of issue.	Date of issue.